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Usui et al.

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(54) **PRINTING METHOD AND APPARATUS, AND BINARY-FORM DITHER MATRIX PATTERN**

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H04N 1/409 (2006.01)
H04N 1/52 (2006.01)
H04N 1/58 (2006.01)

(52) **U.S. Cl.** **358/3.13**; 358/3.17; 358/3.26; 358/3.23; 358/533; 358/535

(58) **Field of Classification Search** 358/1.9, 358/3.06, 3.17, 3.13, 534-536, 3.16, 3.23, 358/3.26, 533

See application file for complete search history.

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ABSTRACT

(57) A method and apparatus for printing a multivalued image in a binary-form output pattern. The printing apparatus employs a binary-form dither matrix pattern which is composed of a greater number of pixels, so that moiré patterns and other artifacts are minimized in printouts. The method includes: providing the binary-form dither matrix pattern for use in obtaining the binary-form output pattern; expanding the multivalued image in a memory area; and forming a binary image of output dot elements in accordance with the binary-form output pattern. The binary-form dither matrix pattern has a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix. The turning-on sequence is set in such a way that plural groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups.

34 Claims, 36 Drawing Sheets

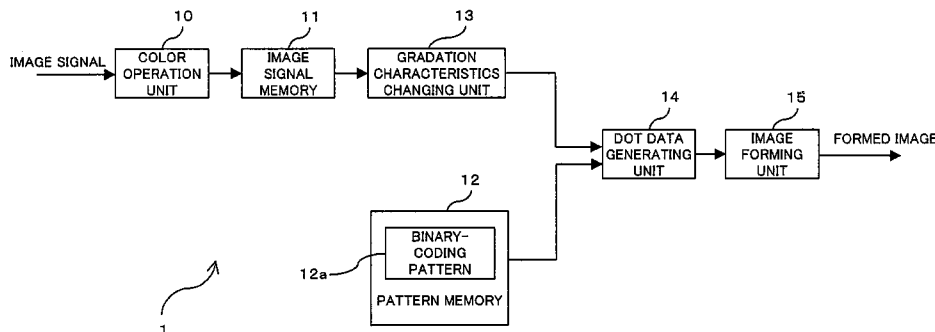


FIG. 1

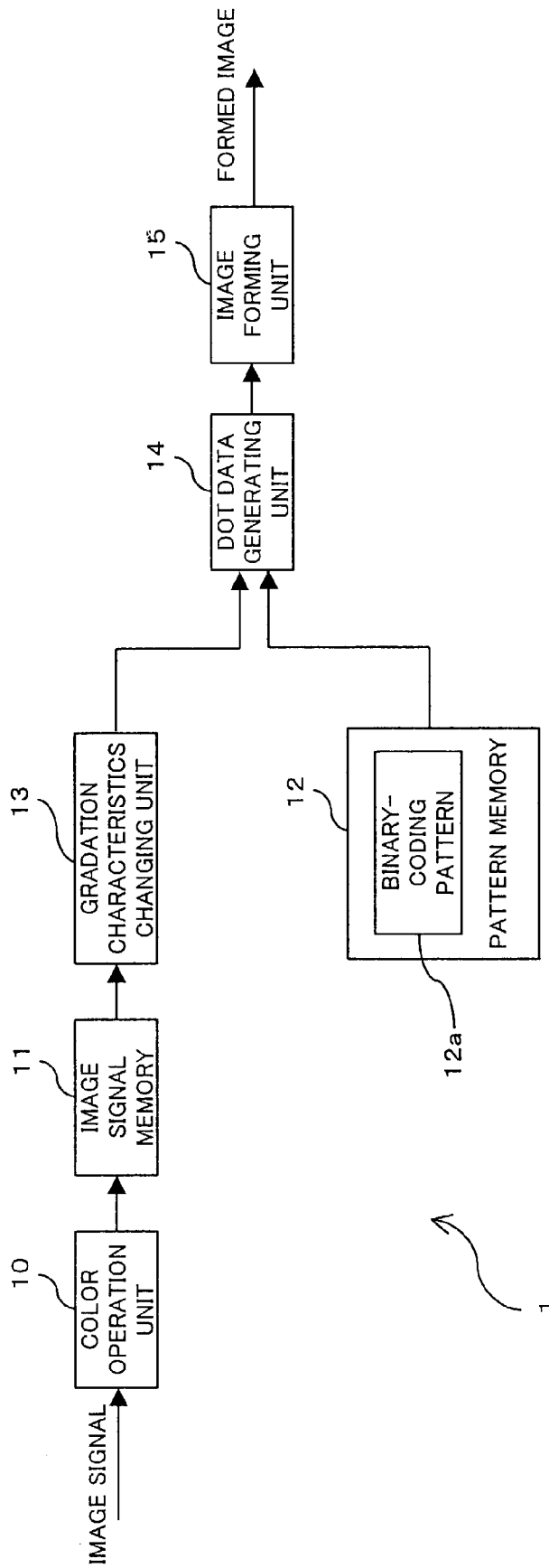


FIG. 2(a)

93	77	53	21	16	48	44	12	17	49	73	89
85	69	29	8	40	64	60	36	4	25	65	81
61	37	5	32	72	88	84	68	28	1	33	57
45	13	24	56	80	96	92	76	52	20	9	41
43	11	18	50	74	90	94	78	54	22	15	47
59	35	3	26	66	82	86	70	30	7	39	63
83	67	27	2	34	58	62	38	6	31	71	87
91	75	51	19	10	42	46	14	23	55	79	95

12a

FIG. 2(b)

93	77	53	21	16	48	44	12	17	49	73	89
85	69	29	8	40	64	60	36	4	25	65	81
61	37	5	32	72	88	84	68	28	1	33	57
45	13	24	56	80	96	92	76	52	20	9	41
43	11	18	50	74	90	94	78	54	22	15	47
59	35	3	26	66	82	86	70	30	7	39	63
83	67	27	2	34	58	62	38	6	31	71	87
91	75	51	19	10	42	46	14	23	55	79	95

12aa

12a

FIG. 3

PIXEL VALUE BEFORE CONVERSION	PIXEL VALUE AFTER CONVERSION										
0	0	46	31	92	83	138	149	184	196	230	242
1	0	47	32	93	84	139	150	185	197	231	242
2	0	48	33	94	86	140	151	186	199	232	243
3	0	49	34	95	87	141	153	187	200	233	244
4	1	50	35	96	88	142	143	188	201	234	245
5	1	51	36	97	89	143	145	189	202	235	246
6	1	52	37	98	91	144	146	190	203	236	246
7	2	53	37	99	92	145	147	191	204	237	247
8	2	54	38	100	93	146	149	192	205	238	247
9	3	55	39	101	95	147	150	193	206	239	248
10	3	56	41	102	96	148	151	194	207	240	249
11	4	57	42	103	97	149	153	195	208	241	249
12	4	58	43	104	99	150	154	196	209	242	250
13	5	59	44	105	100	151	155	197	210	243	250
14	5	60	45	106	101	152	157	198	211	244	251
15	6	61	46	107	103	153	158	199	212	245	251
16	7	62	47	108	104	154	159	200	213	246	252
17	7	63	48	109	105	155	161	201	215	247	252
18	8	64	49	110	107	156	162	202	216	248	253
19	8	65	50	111	108	157	163	203	217	249	253
20	9	66	51	112	109	158	165	204	218	250	253
21	10	67	52	113	111	159	166	205	219	251	254
22	10	68	53	114	112	160	167	206	220	252	254
23	11	69	54	115	114	161	168	207	221	253	254
24	12	70	55	116	115	162	170	208	222	254	254
25	12	71	57	117	116	163	171	209	223	255	255
26	13	72	58	118	119	164	172	210	224		
27	14	73	59	119	121	165	174	211	225		
28	15	74	60	120	122	166	175	212	226		
29	15	75	61	121	123	167	176	213	227		
30	16	76	62	122	125	168	177	214	228		
31	17	77	63	123	126	169	179	215	229		
32	18	78	65	124	128	170	180	216	230		
33	19	79	66	125	129	171	181	217	231		
34	19	80	67	126	131	172	182	218	232		
35	20	81	68	127	132	173	183	219	233		
36	21	82	69	128	133	174	185	220	234		
37	22	83	71	129	136	175	186	221	235		
38	23	84	73	130	139	176	187	222	235		
39	24	85	74	131	140	177	188	223	236		
40	25	86	75	132	142	178	189	224	237		
41	26	87	77	133	142	179	191	225	238		
42	27	88	78	134	143	180	192	226	239		
43	28	89	79	135	145	181	193	227	239		
44	29	90	80	136	146	182	194	228	240		
45	30	91	82	137	147	183	195	229	241		

FIG. 4

93	77	45	13	24	56	52	20	9	41	73	89
85	61	29	8	40	72	68	36	4	25	57	81
69	37	5	32	64	88	84	60	28	1	33	65
53	21	16	48	80	96	92	76	44	12	17	49
51	19	10	42	74	90	84	78	46	14	23	55
67	35	3	26	58	82	86	62	30	7	39	71
83	59	27	2	34	66	70	38	6	31	63	87
91	75	43	11	18	50	54	22	15	47	79	95

12bb

12b

FIG. 5

14	50	82	90	94	74	42	2	12cc
30	54	66	78	86	70	22	6	
11	34	26	46	58	62	38	19	
47	27	35	10	18	39	63	59	
79	67	55	31	7	23	71	87	
91	83	51	15	3	43	75	95	
93	73	41	1	13	49	81	89	
85	69	21	5	29	53	65	77	
57	61	37	20	12	33	25	45	
17	40	64	60	48	28	36	9	
8	24	72	88	80	68	56	32	12cc
4	44	76	96	92	84	52	16	

12c

FIG. 6

14	38	74	90	94	82	42	2	12dd
18	34	62	78	86	70	46	10	
7	22	26	50	58	66	54	31	
51	27	23	6	30	55	67	59	
79	63	35	19	11	47	71	87	
91	75	39	15	3	43	83	95	
93	81	41	1	13	37	73	89	
85	69	45	9	17	33	61	77	
57	65	53	32	8	21	25	49	
29	56	68	60	52	28	24	5	
12	48	72	88	80	64	36	20	12dd
4	44	84	96	92	76	40	16	

12d

FIG. 7

89	77	53	29	16	48	46	14	31	55	79	91
73	65	25	8	44	64	62	42	6	27	67	75
49	21	1	40	72	88	86	70	38	3	23	51
17	9	36	60	84	96	94	82	58	34	11	19
45	13	32	56	80	92	90	78	54	30	15	47
61	41	5	28	68	76	74	66	26	7	43	63
85	69	37	4	24	52	50	22	2	39	71	87
93	81	57	33	12	20	18	10	35	59	83	95

12ee

12e

FIG. 8

89	73	41	9	24	56	54	22	11	43	75	91
81	61	25	8	40	72	70	38	6	27	63	83
57	33	1	32	68	88	86	66	30	3	35	59
49	17	16	48	80	96	94	78	46	14	19	51
53	21	12	44	76	92	90	74	42	10	23	55
69	37	5	28	64	84	82	62	26	7	39	71
85	65	29	4	36	60	58	34	2	31	67	87
93	77	45	13	20	52	50	18	15	47	79	95

12ff

12f

FIG. 9

16	56	84	92	90	76	44	6	12gg
34	54	68	74	82	66	24	4	
11	32	22	42	52	50	30	19	
47	27	37	2	14	39	63	61	
79	69	59	35	9	25	71	87	
93	85	57	17	7	45	77	95	
89	75	43	5	15	55	83	91	
81	65	23	3	33	53	67	73	
51	49	29	20	12	31	21	41	
13	40	64	62	48	28	38	1	
10	26	72	88	80	70	60	36	12gg
8	46	78	96	94	86	58	18	

12g

FIG. 10

14	44	76	90	94	82	42	2	12hh
20	34	62	74	86	70	40	10	
7	18	28	38	58	66	54	31	
51	29	23	6	26	55	67	59	
79	63	35	21	11	49	71	87	
91	77	45	15	3	47	83	95	
93	81	41	1	13	43	75	89	
85	69	39	9	19	33	61	73	
57	65	53	32	8	17	27	37	
25	56	68	60	52	30	24	5	
12	50	72	88	80	64	36	22	12hh
4	48	84	96	92	78	46	16	

12h

FIG. 11

260	69	98	290	434	530	554	458	314	122	92	284	261	69	99	291	435	531	555	459	315	123	93	285
356	212	20	146	386	482	506	410	170	44	236	380	357	213	21	147	387	483	507	411	171	45	237	381
500	404	184	2	194	338	362	218	26	186	428	524	501	405	165	3	195	339	363	219	27	187	429	525
548	452	308	116	50	242	266	74	140	332	476	572	549	453	309	117	51	243	267	75	141	333	477	573
590	464	320	128	86	278	254	62	104	296	440	536	561	465	321	129	87	279	255	63	105	297	441	537
512	416	176	38	230	374	350	206	14	152	392	488	513	417	177	39	231	375	351	207	15	153	393	489
388	224	32	182	422	518	494	398	158	8	200	344	369	225	33	183	423	519	495	399	159	9	201	345
272	80	134	326	470	566	542	446	302	110	56	248	273	81	135	327	471	567	543	447	303	111	57	249
264	72	102	294	438	534	558	462	318	126	96	288	263	71	101	293	437	533	557	461	317	125	95	287
360	216	24	150	390	486	510	414	174	48	240	384	359	215	23	149	389	485	509	413	173	47	239	383
504	408	168	6	198	342	366	222	30	182	432	528	503	407	167	5	197	341	365	221	29	181	431	527
552	456	312	120	54	246	270	78	144	336	480	576	551	455	311	119	53	245	269	77	143	335	479	575
564	468	324	132	90	282	258	66	108	300	444	540	563	467	323	131	89	281	257	65	107	289	443	539
516	420	180	42	234	378	354	210	18	156	396	492	515	419	179	41	233	377	353	209	17	155	395	491
372	228	36	186	426	522	498	402	162	12	204	348	371	227	35	185	425	521	497	401	161	11	203	347
276	84	138	330	474	570	546	450	306	114	58	252	275	83	137	329	473	569	545	449	305	113	59	251
262	70	100	292	436	532	556	460	316	124	94	286	259	67	97	289	433	529	553	457	313	121	91	283
358	214	22	148	388	484	508	412	172	46	238	382	355	211	19	145	385	481	505	409	189	43	235	379
502	406	166	4	196	340	364	220	28	180	430	526	499	403	163	1	193	337	361	217	25	183	427	523
550	454	310	118	52	244	268	76	142	334	478	574	547	451	307	115	49	241	265	73	139	331	475	571
562	466	322	130	88	280	256	64	106	298	442	538	559	463	319	127	85	277	253	61	103	295	439	535
514	418	178	40	232	376	352	208	16	154	394	490	511	415	175	37	229	373	349	205	13	151	391	487
370	226	34	184	424	520	496	400	160	10	202	346	367	223	31	181	421	517	493	397	157	7	199	343
274	82	136	328	472	568	544	448	304	112	56	250	271	79	133	325	469	565	541	445	301	109	55	247

12ii

12ii

12i

12ii

FIG. 12

308/116	50	242	434	530	554	458	266	74	140	332	309	117	51	243	435	531	555	459	267	75	141	333
404/212	20	146	338	482	506	362	170	44	236	428	405	213	21	147	339	483	507	363	171	45	237	429
500/356	164	2	194	386	410	218	26	188	380	524	501	357	165	3	195	387	411	219	27	189	381	525
548/452	268	68	98	290	314	122	82	284	476	572	549	453	261	69	99	291	315	123	83	285	477	573
560/464	272	80	134	326	302	110	56	248	440	536	561	465	273	81	135	327	303	111	57	249	441	537
512/368	176	38	230	422	398	206	14	152	344	488	513	369	177	39	231	423	399	207	15	153	345	489
416/224	82	182	374	518	494	350	158	6	208	392	417	225	33	183	375	519	495	351	159	7	201	393
328/128	86	278	470	566	542	446	254	62	104	296	321	129	87	279	471	567	543	447	255	63	105	297
312/120	54	246	438	534	558	462	270	78	144	336	311	119	53	245	437	533	557	461	269	77	143	335
408/216	24	150	342	486	510	366	174	48	240	432	407	215	23	149	341	485	509	365	173	47	239	431
504/360	168	6	198	390	414	222	30	192	384	528	503	359	167	5	197	389	413	221	29	191	383	527
552/456	284	72	102	294	318	126	88	288	480	576	551	455	283	71	101	293	317	125	85	287	475	575
564/468	276	84	138	330	306	114	60	252	444	540	563	467	275	83	137	329	305	113	59	251	443	539
516/372	180	42	234	426	402	210	18	156	348	492	515	371	179	41	233	425	401	209	17	155	347	491
420/228	36	186	378	522	498	354	162	12	204	396	419	227	35	185	377	521	497	353	161	11	203	395
324/132	90	282	474	570	546	450	258	66	108	300	323	131	89	281	473	569	545	449	257	65	107	299
318/126	52	244	436	532	556	460	268	76	142	334	307	115	49	241	433	529	553	457	265	73	139	331
406/214	22	148	340	484	508	364	172	46	238	430	403	211	19	145	337	481	505	361	169	43	235	427
502/358	188	4	196	388	412	220	28	198	382	526	495	355	163	1	193	385	409	217	25	187	379	523
550/454	262	70	100	292	316	124	84	286	478	574	547	451	259	67	97	289	313	121	81	283	473	571
562/466	274	82	136	328	304	112	58	250	442	538	559	463	271	79	133	325	301	109	55	247	439	535
514/370	178	40	232	424	400	208	16	154	346	490	511	367	175	37	229	421	397	205	13	151	343	487
418/226	84	184	376	520	496	352	160	10	202	394	415	223	31	181	373	517	493	349	157	7	189	391
322/130	88	280	472	568	544	448	256	64	106	298	319	127	85	277	469	565	541	445	253	61	103	295

12j

12j

12j

12j

FIG. 13

82	298	490	538	562	442	250	10	84	390	492	540	564	444	252	12	80	296	488	536	560	440	248	8
178	322	394	466	514	418	130	34	180	324	396	468	516	420	132	36	176	320	392	464	512	416	128	32
64	202	154	274	346	370	226	112	66	204	156	276	348	372	228	114	62	200	152	272	344	368	224	110
280	180	208	58	106	232	376	352	282	162	210	60	108	234	378	354	278	158	206	56	104	230	374	350
472	400	328	184	40	136	424	520	474	402	330	186	42	138	426	522	470	398	326	182	38	134	422	518
544	496	304	88	16	256	448	568	546	498	306	90	18	258	450	570	542	494	302	86	14	254	446	566
556	436	244	4	76	292	484	532	558	438	246	6	78	294	486	534	554	434	242	2	74	290	482	530
508	412	124	28	172	316	388	460	510	414	126	30	174	318	390	462	506	410	122	26	170	314	386	458
340	364	220	118	70	196	148	268	342	366	222	120	72	198	150	270	338	362	218	116	68	194	146	266
100	238	382	358	286	166	214	52	102	240	384	360	288	168	216	54	98	236	380	356	284	164	212	50
46	142	430	528	478	408	334	198	48	144	432	528	480	408	336	192	44	140	428	524	476	404	332	188
22	262	354	574	550	302	310	94	24	264	456	576	552	504	312	96	26	260	452	572	548	500	308	92
79	295	487	535	559	439	247	7	83	299	491	539	563	443	251	11	81	297	489	537	561	441	249	9
175	319	391	463	511	415	127	31	179	323	395	467	515	419	131	35	177	321	393	465	513	417	129	33
61	199	151	271	343	367	223	109	65	203	155	275	347	371	227	113	63	201	153	273	345	369	225	111
277	157	205	55	103	229	373	349	281	161	209	59	107	233	377	353	279	159	207	57	105	231	375	351
469	397	325	181	37	133	421	517	473	401	329	185	41	137	425	521	471	399	327	183	39	135	423	519
541	493	301	85	13	253	445	565	545	497	305	89	17	257	449	569	543	495	303	87	15	255	447	567
553	433	241	1	73	289	481	529	557	437	245	5	77	293	485	533	555	435	243	3	75	291	483	531
505	409	121	25	169	313	385	457	509	413	125	29	173	317	389	461	507	411	123	27	171	315	387	459
337	361	217	115	67	193	145	265	341	365	221	119	71	197	149	269	339	363	219	117	69	195	147	267
97	235	379	355	283	163	211	49	101	239	383	359	287	167	215	53	99	237	381	357	285	165	213	51
43	139	427	523	475	403	331	187	47	143	431	527	479	407	335	191	45	141	429	525	477	405	333	189
19	259	451	571	547	399	307	91	23	263	455	575	551	503	311	95	21	261	453	573	549	501	309	89

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12k

FIG. 14

The figure shows a grid of numbers arranged in 20 rows and 30 columns. The numbers are organized into a pattern of 10x5 blocks. The first row of numbers is: 82, 226, 442, 538, 562, 490, 250, 10, 84, 228, 444, 540, 564, 492, 252, 12, 80, 224, 440, 536, 560, 488, 248, 8. The second row is: 106, 202, 370, 466, 514, 418, 274, 58, 108, 204, 372, 468, 516, 420, 276, 60, 104, 200, 368, 464, 512, 416, 272, 56. The third row is: 40, 130, 154, 298, 346, 394, 322, 184, 42, 132, 156, 300, 348, 396, 324, 186, 38, 128, 152, 296, 344, 392, 320, 182. The fourth row is: 304, 160, 136, 34, 178, 328, 400, 352, 306, 162, 138, 36, 180, 330, 402, 354, 302, 158, 134, 32, 176, 326, 398, 350. The fifth row is: 472, 376, 208, 112, 64, 280, 424, 520, 474, 378, 210, 114, 66, 282, 426, 522, 470, 374, 206, 110, 62, 278, 422, 518. The sixth row is: 544, 448, 232, 88, 16, 256, 496, 568, 546, 450, 234, 90, 18, 258, 498, 570, 542, 446, 230, 86, 14, 254, 494, 566. The seventh row is: 556, 484, 244, 4, 76, 220, 436, 532, 558, 486, 246, 6, 78, 222, 438, 534, 554, 482, 242, 2, 74, 218, 434, 530. The eighth row is: 508, 412, 268, 52, 100, 196, 364, 460, 510, 414, 270, 54, 102, 198, 366, 462, 506, 410, 266, 50, 98, 194, 362, 458. The ninth row is: 340, 388, 316, 190, 46, 124, 148, 292, 342, 390, 318, 192, 48, 126, 150, 294, 338, 386, 314, 186, 44, 122, 146, 290. The tenth row is: 172, 334, 406, 358, 310, 166, 142, 28, 174, 336, 408, 360, 312, 168, 144, 30, 170, 332, 404, 356, 308, 164, 140, 26. The eleventh row is: 70, 286, 430, 526, 478, 382, 214, 118, 72, 288, 432, 528, 480, 384, 216, 120, 68, 284, 428, 524, 476, 380, 212, 116. The twelfth row is: 22, 282, 502, 574, 550, 454, 238, 94, 24, 284, 504, 576, 552, 456, 240, 96, 20, 260, 500, 572, 548, 452, 236, 92. The thirteenth row is: 19, 223, 439, 535, 559, 487, 247, 7, 83, 227, 443, 539, 563, 491, 251, 11, 81, 225, 441, 537, 561, 489, 249, 9. The fourteenth row is: 103, 199, 367, 463, 511, 415, 271, 65, 107, 203, 371, 467, 515, 419, 273, 69, 105, 201, 369, 465, 513, 417, 273, 57. The fifteenth row is: 37, 127, 151, 295, 343, 391, 319, 181, 41, 131, 155, 299, 347, 395, 323, 185, 39, 129, 153, 297, 345, 393, 321, 183. The sixteenth row is: 301, 157, 133, 31, 175, 325, 397, 349, 305, 161, 137, 35, 179, 329, 401, 353, 303, 159, 135, 33, 177, 327, 399, 351. The seventeenth row is: 469, 373, 205, 109, 61, 277, 421, 517, 473, 377, 209, 113, 65, 281, 425, 521, 471, 375, 207, 111, 63, 279, 423, 519. The eighteenth row is: 541, 445, 229, 85, 13, 253, 493, 565, 545, 449, 233, 89, 17, 257, 497, 569, 543, 447, 231, 87, 15, 255, 495, 567. The nineteenth row is: 553, 481, 241, 1, 73, 217, 433, 529, 557, 485, 245, 5, 77, 221, 437, 533, 555, 483, 243, 3, 75, 219, 435, 531. The twentieth row is: 505, 409, 265, 49, 97, 193, 361, 457, 509, 413, 269, 53, 101, 197, 365, 461, 507, 411, 267, 51, 99, 195, 363, 459. The twenty-first row is: 337, 385, 313, 187, 43, 121, 145, 289, 341, 389, 317, 191, 47, 125, 149, 293, 339, 387, 315, 189, 45, 123, 147, 291. The twenty-second row is: 169, 331, 403, 355, 307, 163, 139, 25, 173, 335, 407, 359, 311, 167, 143, 29, 171, 333, 405, 357, 309, 165, 141, 27. The twenty-third row is: 67, 283, 427, 523, 475, 379, 211, 115, 71, 287, 431, 527, 479, 383, 215, 119, 69, 285, 429, 525, 477, 381, 213, 117. The twenty-fourth row is: 19, 259, 499, 571, 547, 451, 235, 91, 23, 263, 503, 575, 551, 455, 239, 95, 21, 261, 501, 573, 549, 453, 237, 93. Arrows labeled 1211 point to the first, third, and fourth rows. An arrow labeled 121 points to the bottom of the grid.

FIG. 15

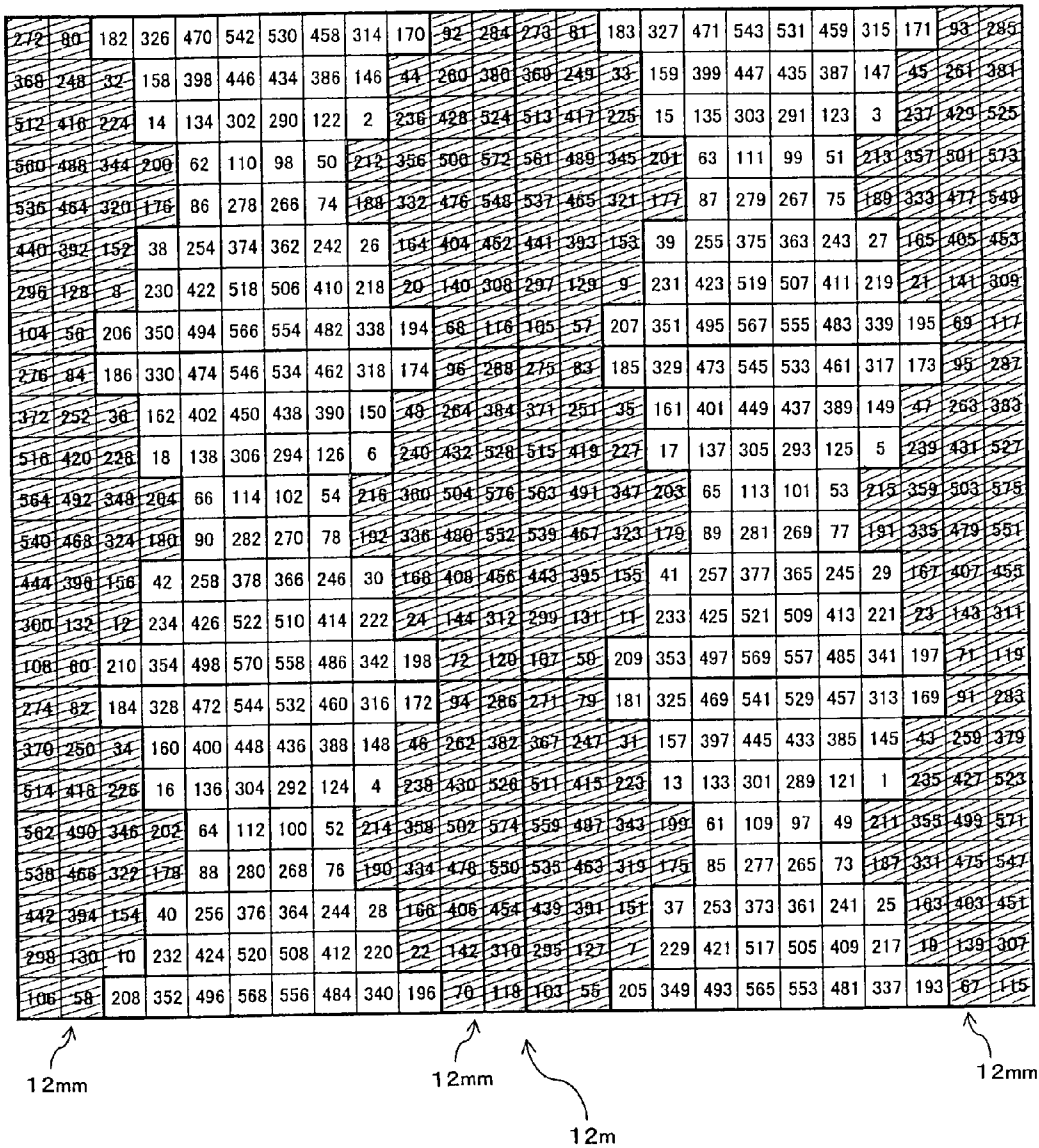


FIG. 16

320	128	62	254	446	542	530	434	242	50	140	332	321	129	63	255	447	543	531	435	243	51	141	333
416	224	32	158	374	494	482	362	146	44	236	428	417	225	33	159	375	495	483	363	147	45	237	429
512	392	176	14	206	350	338	194	2	188	404	524	513	303	177	15	207	351	339	195	3	189	405	525
560	464	272	80	110	302	290	98	92	284	476	572	561	465	273	81	111	303	291	99	90	285	477	573
536	440	248	56	134	326	314	122	68	260	452	548	537	441	249	57	135	327	315	123	69	261	453	549
488	368	152	38	230	422	410	218	26	164	380	500	489	369	153	39	231	423	411	219	27	165	381	501
344	200	8	182	398	518	506	386	170	20	212	356	345	201	9	183	399	519	507	387	171	21	213	357
296	104	86	278	470	566	554	458	266	74	116	308	297	105	87	279	471	567	555	459	267	75	117	309
324	132	66	258	450	546	534	438	246	54	144	336	325	131	65	257	449	545	533	437	245	53	143	335
420	228	36	162	378	498	486	366	150	48	240	432	419	227	35	161	377	497	485	365	149	47	239	431
516	396	180	18	210	354	342	198	6	192	408	528	515	305	179	17	209	353	341	197	5	191	407	527
564	468	276	84	114	306	294	102	96	288	480	576	563	467	275	83	113	305	293	101	95	287	479	575
540	444	252	60	138	330	318	126	72	264	456	552	539	443	251	59	137	329	317	125	71	263	455	551
492	372	156	42	234	426	414	222	30	168	384	504	491	371	155	41	233	425	413	221	29	167	383	503
348	204	12	186	402	522	510	390	174	24	216	360	347	203	11	185	401	521	509	389	173	23	215	361
300	108	90	282	474	570	558	462	270	78	120	312	299	107	89	281	473	569	557	461	269	77	119	311
322	130	64	256	448	544	532	436	244	52	142	334	319	127	61	253	445	541	529	433	241	49	139	331
418	226	34	160	376	496	484	364	148	46	238	430	415	223	31	157	373	493	481	361	145	43	235	427
514	394	178	16	208	352	340	196	4	190	406	526	511	301	175	13	205	349	337	193	1	187	403	523
562	466	274	82	112	304	292	100	94	286	478	574	560	463	271	79	109	301	289	97	91	283	475	571
538	442	250	58	136	328	316	124	70	262	454	550	535	439	247	55	133	325	313	121	67	259	451	547
490	370	154	40	232	424	412	220	28	166	382	502	487	367	151	37	229	421	409	217	25	163	379	499
346	202	10	184	400	520	508	388	172	22	214	358	343	199	7	181	397	517	505	385	169	19	211	365
298	106	88	280	472	568	556	460	268	76	118	310	295	103	85	277	469	565	553	457	265	73	115	307

12nn

12nn

12n

12nn

FIG. 17

94	384	502	550	588	464	262	34	96	336	504	552	540	456	264	36	92	332	500	548	586	452	260	32
202	322	406	442	480	394	142	22	204	324	408	444	482	396	144	24	200	320	404	440	478	392	140	20
64	190	130	250	310	298	178	112	66	192	132	252	312	300	180	114	62	188	128	248	308	296	176	110
280	160	220	10	82	232	376	364	282	162	222	12	84	234	378	366	278	158	218	9	80	230	374	362
472	412	352	208	52	148	424	520	474	414	354	210	54	150	426	522	470	410	350	206	50	146	422	518
556	508	340	100	40	268	460	568	558	510	342	102	42	270	462	570	554	506	338	98	38	266	458	566
532	448	256	28	88	328	496	544	534	450	258	30	90	330	498	546	530	446	254	26	86	326	494	542
484	388	136	16	196	316	400	436	486	390	138	18	198	318	402	438	482	386	134	14	194	314	398	434
304	292	172	118	70	184	124	244	306	294	174	120	72	186	126	246	302	290	170	116	68	182	122	242
76	238	382	370	286	168	226	4	78	240	384	372	288	168	228	6	74	236	380	368	284	164	224	2
58	154	430	526	478	418	358	214	60	156	432	528	480	420	360	216	58	152	428	524	476	416	356	212
46	274	466	574	562	514	346	106	48	276	468	576	564	516	348	108	44	272	464	572	560	512	344	104
91	331	499	647	535	451	289	31	95	335	503	651	539	455	293	35	91	333	501	649	537	453	287	29
189	319	403	439	487	391	139	19	203	323	407	443	491	395	143	23	201	321	405	441	489	393	141	21
61	187	127	247	307	295	175	109	65	191	131	251	311	299	179	113	63	189	129	249	309	297	177	111
277	157	217	7	79	229	373	361	281	161	221	11	81	233	377	365	279	159	219	9	81	231	375	363
469	409	349	205	49	145	421	517	473	413	353	209	53	149	425	521	471	411	351	207	51	147	423	519
553	505	337	97	37	265	457	565	557	509	341	101	41	269	461	569	555	507	339	99	39	267	459	567
529	445	253	25	85	325	493	541	533	449	257	29	89	329	497	545	531	447	255	27	87	327	495	543
481	385	133	13	193	313	397	433	485	389	137	17	197	317	401	437	483	387	135	15	195	315	399	435
301	289	169	115	67	181	121	241	305	293	173	119	71	185	125	245	303	291	171	117	69	183	123	243
73	235	379	367	283	163	223	1	77	239	381	371	287	167	227	5	75	237	381	369	285	165	225	3
55	151	427	523	475	415	355	211	59	153	431	527	479	419	359	215	57	153	429	525	477	417	357	213
43	271	463	571	559	511	343	103	47	275	467	575	563	515	347	107	45	273	465	573	561	513	345	105

1200

FIG. 18

82	262	454	538	562	490	250	10	84	264	458	540	564	492	252	12	80	260	452	536	560	488	248	8
118	202	370	442	514	418	238	58	120	204	372	444	516	420	240	60	118	200	368	440	512	416	236	56
40	106	166	226	346	394	322	184	42	108	168	228	348	396	324	186	38	104	164	224	344	392	320	182
304	172	136	34	154	328	400	352	306	174	138	36	156	330	402	354	302	170	134	32	152	326	398	350
472	376	208	124	64	292	424	520	474	378	210	126	66	294	426	522	470	374	206	122	62	290	422	518
544	460	268	88	16	280	496	568	546	462	270	90	18	282	498	570	542	458	266	86	14	278	494	566
556	484	244	4	76	256	448	532	558	486	246	6	78	258	450	534	554	482	242	2	74	254	446	530
508	412	232	52	112	196	364	436	510	414	234	54	114	198	366	438	506	410	230	50	110	194	362	434
340	388	316	190	46	100	160	220	342	390	318	192	48	102	162	222	338	386	314	188	44	98	158	218
148	334	406	358	310	178	142	28	150	336	408	360	312	180	144	30	146	332	404	356	308	176	140	26
70	298	430	526	478	382	214	130	72	300	432	528	480	384	216	132	68	296	428	524	476	380	212	128
22	286	502	574	550	466	274	94	24	288	504	576	552	468	276	96	20	284	500	572	548	464	272	92
78	259	481	535	559	487	247	7	63	263	455	539	563	491	251	11	61	261	453	537	561	489	249	9
115	190	367	439	511	415	236	55	118	203	371	443	515	419	238	59	117	201	369	441	513	417	237	57
37	103	163	223	343	391	319	181	41	107	167	227	347	395	323	185	39	105	165	225	345	393	321	183
301	169	133	31	151	325	397	349	305	173	137	35	155	329	401	353	303	171	135	33	153	327	399	351
469	373	205	121	61	289	421	517	473	377	209	125	65	293	425	521	471	375	207	123	63	291	423	519
541	457	265	85	13	277	493	565	545	461	269	89	17	281	497	569	543	459	267	87	15	279	495	567
553	481	241	1	73	253	445	529	557	485	245	5	77	257	449	533	555	483	243	3	75	255	447	531
505	409	229	49	109	193	361	433	509	413	233	53	113	197	365	437	507	411	231	51	111	195	363	435
337	385	313	187	43	97	157	217	341	389	317	191	47	101	161	221	339	387	315	189	45	99	159	219
145	331	403	365	307	175	139	25	149	335	407	359	311	179	143	29	147	333	405	357	309	177	141	27
67	295	427	523	475	379	211	127	71	299	431	527	479	383	213	131	69	297	429	525	477	381	213	129
19	283	499	571	547	463	271	91	23	287	503	575	551	467	273	93	21	285	501	573	549	465	273	93

12p

FIG. 19

4	20	44	76	81	49	53	85	80	48	24	8
12	28	68	89	57	33	37	61	93	72	32	16
36	60	92	65	25	9	13	29	69	96	64	40
52	84	73	41	17	1	5	21	45	77	88	56
54	86	79	47	23	7	3	19	43	75	82	50
38	62	94	71	31	15	11	27	67	90	58	34
14	30	70	85	63	39	35	59	91	66	26	10
6	22	46	78	87	55	51	83	74	42	18	2

12a'

12aa'

FIG. 20

4	20	52	84	73	41	45	77	88	56	24	8
12	36	68	89	57	25	29	61	93	72	40	16
28	60	92	65	33	9	13	37	69	96	64	32
44	76	81	49	17	1	5	21	53	85	80	48
46	78	87	55	23	7	3	19	51	83	74	42
30	62	94	71	39	15	11	35	67	90	58	26
14	38	70	95	63	31	27	59	91	66	34	10
6	22	54	86	79	47	43	75	82	50	18	2

12b'

12bb'

FIG. 21

83	47	15	7	3	23	55	95
67	43	31	19	11	27	75	91
86	63	71	51	39	35	59	78
50	70	62	87	79	58	34	38
18	30	42	66	90	74	26	10
6	14	46	82	94	54	22	2
4	24	56	96	84	48	16	8
12	28	76	92	68	44	32	20
40	36	60	77	85	64	72	52
80	57	33	37	49	69	61	88
89	73	25	9	17	29	41	65
93	53	21	1	5	13	45	81

12cc'

12cc'

12c'

FIG. 22

83	59	23	7	3	15	55	95	12dd'
79	63	35	19	11	27	51	87	
90	75	71	47	39	31	43	66	
46	70	74	91	67	42	30	38	
18	34	62	78	86	50	26	10	
6	22	58	82	94	54	14	2	
4	16	56	96	84	60	24	8	
12	28	52	88	80	64	36	20	
40	32	44	65	89	76	72	48	
68	41	29	37	45	69	73	92	
85	49	25	9	17	33	61	77	12dd'
93	53	13	1	5	21	57	81	

12d'

FIG. 23

8	20	44	68	81	49	51	83	66	42	18	6
24	32	72	89	53	33	35	55	91	70	30	22
48	76	96	57	25	9	11	27	59	94	74	46
80	88	61	37	13	1	3	15	39	63	86	78
52	84	65	41	17	5	7	19	43	67	82	50
36	56	92	69	29	21	23	31	71	90	54	34
12	28	60	93	73	45	47	75	95	58	26	10
4	16	40	64	85	77	79	87	62	38	14	2

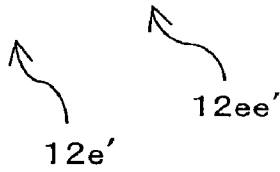


FIG. 24

8	24	56	88	73	41	43	75	86	54	22	6
16	36	72	89	57	25	27	59	91	70	34	14
40	64	96	65	29	9	11	31	67	94	62	38
48	80	81	49	17	1	3	19	51	83	78	46
44	76	85	53	21	5	7	23	55	87	74	42
28	60	92	69	33	13	15	35	71	90	58	26
12	32	68	93	61	37	39	63	95	66	30	10
4	20	52	84	77	45	47	79	82	50	18	2

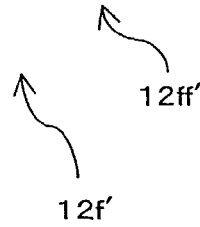


FIG. 25

81	41	13	5	7	21	53	91
63	43	29	23	15	31	73	93
86	65	75	55	45	47	67	78
50	70	60	95	83	58	34	36
18	28	38	62	88	72	26	10
4	12	40	80	90	52	20	2
8	22	54	92	82	42	14	6
16	32	74	94	64	44	30	24
46	48	68	77	85	66	76	56
84	57	33	35	49	69	59	96
87	71	25	9	17	27	37	61
89	51	19	1	3	11	39	79

12_{gg'}

12_{gg'}

12_{g'}

FIG. 26

83	53	21	7	3	15	55	95
77	63	35	23	11	27	57	87
90	79	69	59	39	31	43	66
46	68	74	91	71	42	30	38
18	34	62	76	86	48	26	10
6	20	52	82	94	50	14	2
4	16	56	96	84	54	22	8
12	28	58	88	78	64	36	24
40	32	44	65	89	80	70	60
72	41	29	37	45	67	73	92
85	47	25	9	17	33	61	75
93	49	13	1	5	19	51	81

12hh'

12hh'

12h'

FIG. 27

317	509	479	287	143	47	23	119	263	455	485	293	316	508	478	286	142	46	22	118	262	454	484	292
227	365	557	431	191	95	71	167	407	533	341	197	220	364	556	430	190	94	70	166	406	532	340	196
77	73	413	575	383	239	215	359	551	389	149	53	76	172	442	574	382	238	214	358	550	388	148	52
29	125	269	461	527	335	311	503	437	245	101	5	28	124	268	460	526	334	310	502	436	244	100	4
17	113	257	449	491	299	323	515	473	281	137	41	16	112	256	448	490	298	322	514	472	280	136	40
65	161	401	539	347	203	227	371	563	425	185	89	64	180	400	538	346	202	226	370	562	424	184	88
208	353	545	395	155	59	83	179	419	569	377	233	208	352	544	394	154	58	82	178	418	568	376	232
305	497	443	251	107	11	35	131	275	467	527	329	304	496	442	250	106	10	34	130	274	466	526	328
813	505	475	283	139	43	19	115	259	451	481	289	314	506	476	284	140	44	20	116	260	452	482	290
217	361	553	427	187	91	67	163	403	529	337	193	218	362	554	428	188	92	68	164	404	530	338	194
73	169	409	571	379	235	211	355	547	385	145	49	74	170	440	572	380	236	212	356	548	386	146	50
25	121	265	457	523	331	307	499	433	241	97	1	26	122	266	458	524	332	308	500	434	242	98	2
18	109	253	445	487	295	319	511	469	277	133	37	14	110	254	446	488	296	320	512	470	278	134	38
61	157	397	535	343	199	223	367	559	421	181	85	62	158	398	536	344	200	224	368	560	422	182	86
205	349	541	391	151	55	79	175	415	565	373	229	206	350	542	392	152	56	80	176	416	566	374	230
301	493	439	247	103	7	31	127	271	463	517	325	302	494	440	248	104	8	32	128	272	464	518	326
315	507	477	285	141	45	21	117	261	453	483	291	318	510	480	288	144	48	24	120	264	456	486	294
219	363	555	429	189	93	69	165	405	531	339	195	222	366	558	432	192	96	72	168	408	534	342	198
75	171	411	573	381	237	213	357	549	387	147	51	75	174	414	576	384	240	216	360	552	390	150	54
27	123	267	459	525	333	309	501	435	243	99	3	30	126	270	462	528	336	312	504	438	246	102	6
19	111	255	447	489	297	321	513	471	279	135	39	18	114	258	450	492	300	324	516	474	282	138	42
63	159	399	537	345	201	225	369	561	423	183	87	66	162	402	540	348	204	228	372	564	426	186	90
207	351	543	393	153	57	81	177	417	567	375	231	210	354	546	396	156	60	84	180	420	570	378	234
303	495	441	249	105	9	33	129	273	465	519	327	306	498	444	252	108	12	36	132	276	468	522	330

12ii'

12ii'

12i'

12ii'

FIG. 28

269	461	527	335	143	47	23	119	311	503	497	245	268	460	526	334	142	46	22	118	310	502	496	244
173	365	557	431	239	95	71	215	407	533	341	149	172	364	556	430	238	94	70	214	406	532	340	148
77	221	413	575	383	191	167	359	551	389	197	53	76	220	412	574	382	190	166	358	550	388	196	52
29	125	317	509	479	287	263	455	485	293	101	5	28	124	316	508	478	286	262	454	484	292	100	4
17	113	305	497	443	251	275	467	521	329	187	41	16	112	304	496	442	250	274	466	520	328	136	40
65	209	401	539	347	155	179	371	563	425	233	89	64	208	400	538	346	154	178	370	562	424	232	88
161	353	545	395	203	59	83	227	419	569	377	165	160	352	544	394	202	58	82	226	418	568	376	164
257	449	491	299	107	11	35	131	323	515	473	281	256	448	490	298	106	10	34	130	322	514	472	280
265	457	523	331	139	43	19	115	307	499	433	241	266	456	524	332	140	44	20	116	308	500	434	242
189	361	553	427	235	91	67	211	403	529	337	145	170	362	554	428	236	92	68	212	404	530	338	146
73	217	409	571	379	187	163	355	547	385	193	49	74	216	410	572	380	188	164	356	548	386	194	50
25	121	313	505	475	283	259	451	481	289	97	1	26	122	314	506	476	284	260	452	482	290	98	2
13	109	301	493	439	247	271	463	517	325	133	37	14	110	302	494	440	248	272	464	518	326	134	38
61	205	397	535	343	151	175	367	559	421	229	85	61	206	398	536	344	152	176	368	560	422	230	86
157	349	541	391	199	55	79	223	415	565	373	161	158	350	542	392	200	56	80	224	416	566	374	162
253	445	487	295	103	7	31	127	319	511	469	277	254	446	488	296	104	8	32	128	320	512	470	278
267	459	525	333	141	45	21	117	309	501	435	243	270	462	528	336	144	48	24	120	312	504	438	246
171	363	555	429	237	93	69	213	405	531	339	147	174	366	558	432	240	96	72	216	408	534	342	150
75	219	411	573	381	189	165	357	549	387	195	51	78	222	414	576	384	192	168	360	552	390	198	54
27	123	315	507	477	285	261	453	483	291	99	3	30	126	318	510	480	288	264	456	486	294	102	6
15	111	303	495	441	249	273	465	519	327	135	39	18	114	306	498	444	252	276	468	522	330	138	42
63	207	399	537	345	153	177	369	561	423	231	87	66	210	402	540	348	156	180	372	564	426	234	90
159	351	543	393	201	57	81	225	417	567	375	163	162	354	546	396	204	60	84	228	420	570	378	166
255	447	489	297	105	9	33	129	321	513	471	279	258	450	492	300	108	12	36	132	324	516	474	282

12j'

12j'

12j'

12j'

FIG. 29

The figure shows a grid of numbers arranged in 20 rows and 25 columns. The numbers are: 495, 279, 87, 39, 15, 135, 327, 567, 493, 277, 85, 37, 13, 133, 325, 565, 497, 281, 89, 41, 17, 137, 329, 569, 389, 255, 183, 111, 63, 159, 447, 543, 397, 253, 181, 109, 61, 157, 445, 541, 401, 257, 185, 113, 65, 161, 449, 545, 513, 375, 423, 303, 231, 207, 351, 465, 511, 373, 421, 301, 229, 203, 349, 463, 515, 377, 425, 305, 233, 209, 353, 467, 297, 417, 369, 519, 471, 345, 201, 225, 295, 415, 367, 517, 469, 343, 199, 223, 299, 419, 371, 521, 473, 347, 203, 227, 105, 177, 249, 393, 537, 441, 153, 57, 103, 175, 247, 391, 535, 439, 151, 55, 107, 179, 251, 395, 539, 443, 155, 59, 33, 81, 273, 489, 561, 321, 129, 9, 31, 79, 271, 487, 559, 319, 127, 7, 35, 83, 275, 491, 563, 323, 131, 11, 21, 141, 333, 573, 501, 285, 93, 45, 19, 139, 331, 571, 499, 283, 91, 43, 23, 143, 335, 575, 503, 287, 95, 47, 69, 165, 453, 549, 405, 261, 189, 117, 67, 163, 451, 547, 403, 259, 187, 115, 71, 167, 455, 551, 407, 263, 191, 119, 237, 213, 357, 459, 507, 381, 429, 309, 235, 211, 355, 457, 505, 379, 427, 307, 239, 215, 359, 461, 509, 383, 431, 311, 477, 339, 195, 219, 291, 411, 363, 525, 475, 337, 193, 217, 289, 409, 361, 523, 479, 341, 197, 221, 293, 413, 365, 527, 531, 435, 147, 51, 99, 171, 243, 387, 529, 433, 145, 49, 97, 169, 241, 385, 533, 437, 149, 53, 101, 173, 245, 389, 555, 315, 123, 3, 27, 75, 267, 483, 553, 313, 121, 1, 25, 73, 265, 481, 567, 317, 125, 5, 29, 77, 269, 485, 498, 282, 90, 42, 18, 138, 330, 570, 494, 278, 86, 38, 14, 134, 326, 566, 496, 280, 88, 40, 16, 136, 328, 568, 402, 258, 186, 114, 66, 162, 450, 546, 398, 254, 182, 110, 62, 158, 446, 542, 400, 256, 184, 112, 64, 160, 448, 544, 516, 378, 426, 306, 234, 210, 354, 468, 512, 374, 422, 302, 230, 206, 350, 464, 514, 376, 424, 304, 232, 208, 352, 466, 300, 420, 372, 522, 474, 348, 204, 228, 296, 416, 368, 518, 470, 344, 200, 224, 298, 418, 370, 520, 472, 346, 202, 226, 108, 180, 252, 396, 540, 444, 156, 60, 104, 176, 248, 392, 536, 440, 152, 56, 106, 178, 250, 394, 538, 442, 154, 58, 36, 84, 276, 492, 564, 324, 132, 12, 32, 80, 272, 488, 560, 320, 128, 8, 34, 82, 274, 490, 562, 322, 130, 10, 24, 144, 336, 576, 504, 288, 96, 48, 20, 140, 332, 572, 500, 284, 92, 44, 22, 142, 334, 574, 502, 286, 94, 46, 72, 168, 456, 552, 408, 264, 192, 120, 68, 164, 452, 548, 404, 260, 188, 116, 70, 166, 454, 550, 406, 262, 190, 118, 240, 216, 360, 462, 510, 384, 432, 312, 236, 212, 356, 458, 506, 380, 428, 308, 238, 214, 358, 460, 508, 382, 430, 310, 480, 342, 198, 222, 294, 414, 366, 528, 476, 338, 194, 218, 290, 410, 362, 524, 478, 340, 196, 220, 292, 412, 364, 526, 534, 438, 150, 54, 102, 174, 246, 390, 536, 434, 146, 50, 98, 170, 242, 386, 532, 436, 148, 52, 100, 172, 244, 388, 558, 318, 126, 6, 30, 78, 270, 486, 554, 314, 122, 2, 26, 74, 266, 482, 556, 316, 124, 4, 28, 76, 268, 484.

FIG. 30

The figure shows a grid of numbers arranged in 20 rows and 20 columns. The grid is labeled with arrows and reference numerals: 1211' points to the first row, 1211' points to the first column, and 121' points to the bottom center of the grid.

495	351	135	39	15	87	327	567	493	349	133	37	13	85	325	565	497	353	137	41	17	89	329	569
471	375	207	111	63	159	303	519	469	373	205	109	61	157	301	517	473	377	209	113	65	161	305	521
537	447	423	279	231	193	255	393	535	445	421	277	229	181	253	391	539	449	425	281	233	185	257	395
273	417	441	543	399	249	177	225	271	415	439	541	397	247	175	223	275	419	443	545	401	251	179	227
105	201	369	465	513	297	153	57	103	199	367	463	511	295	151	55	107	203	371	467	515	299	155	59
33	129	345	489	561	321	81	9	31	127	343	487	559	319	79	7	35	131	347	491	563	323	83	11
21	93	333	573	501	357	141	45	19	91	331	571	499	355	139	43	23	95	335	575	503	359	143	47
69	165	309	525	477	381	213	117	67	163	307	523	475	379	211	115	71	167	311	527	479	383	215	119
237	189	261	387	531	453	429	285	235	187	259	385	529	451	427	283	239	191	263	389	533	455	431	287
405	243	171	219	267	411	435	549	403	241	169	217	265	409	433	547	407	245	173	221	269	413	437	551
507	291	147	61	99	195	363	459	505	289	145	49	97	193	361	457	509	293	149	63	101	197	365	461
555	315	75	3	27	123	339	483	553	313	73	1	25	121	337	481	557	317	77	5	29	125	341	485
498	354	138	42	18	90	330	570	484	350	134	38	14	86	326	566	496	352	136	40	16	88	328	568
474	378	219	114	66	162	306	522	470	374	206	110	62	158	302	518	472	376	208	112	64	160	304	520
540	450	426	282	234	186	258	396	536	446	422	278	230	182	254	392	538	448	424	280	232	184	256	394
276	420	444	546	402	252	180	228	272	416	440	542	398	248	176	224	274	418	442	544	400	250	178	226
108	204	372	468	516	300	156	60	104	200	368	464	512	296	152	56	106	202	370	466	514	298	154	58
36	132	348	492	564	324	84	12	32	128	344	488	560	320	80	8	34	130	346	490	562	322	82	10
24	96	336	576	504	360	144	48	20	92	332	572	500	356	140	44	22	94	334	574	502	358	142	46
72	168	312	528	480	384	216	120	68	164	308	524	476	380	212	116	70	166	310	526	478	382	214	118
240	192	264	390	534	456	432	288	236	188	260	386	530	452	428	284	238	190	262	388	532	454	430	286
408	246	174	222	270	414	438	552	404	242	170	218	266	410	434	548	406	244	172	220	268	412	436	550
510	294	150	54	102	198	366	462	506	290	146	50	98	194	362	458	508	292	148	52	100	196	364	460
558	318	78	6	30	126	342	486	554	314	74	2	26	122	338	482	556	316	76	4	28	124	340	484

FIG. 31

305	497	395	251	107	35	47	119	263	407	485	299	304	496	394	250	106	34	46	118	262	406	484	292
209	329	545	419	179	131	143	191	431	538	317	187	208	328	544	418	178	130	142	190	430	532	316	196
65	161	359	563	443	275	287	455	575	841	149	53	64	160	352	562	442	274	286	454	574	840	148	52
17	89	233	377	515	467	479	527	365	221	77	5	16	88	232	376	514	466	478	526	364	220	76	4
41	113	257	401	491	299	311	503	399	245	101	29	40	112	256	400	490	298	310	502	388	244	100	28
137	185	425	539	323	203	215	335	551	413	173	125	136	184	424	538	322	202	214	334	550	412	172	124
281	449	569	347	155	59	71	167	359	557	437	269	280	448	568	346	154	58	70	166	358	556	436	268
473	521	371	227	83	11	23	95	239	383	509	461	472	520	370	226	82	10	22	94	238	382	508	460
301	493	391	247	103	31	43	115	259	403	481	289	302	494	392	248	104	32	44	116	260	404	482	290
205	325	541	415	175	127	139	187	427	529	313	193	206	326	542	416	176	128	140	188	428	530	314	194
61	157	349	559	439	271	283	451	571	837	145	49	62	158	350	560	440	272	284	452	572	838	146	50
13	85	229	373	511	463	475	523	361	217	73	1	14	86	230	374	512	464	476	524	362	218	74	2
37	109	253	397	487	295	307	499	385	241	97	25	38	110	254	398	488	296	308	500	386	242	98	26
133	181	421	535	319	199	211	331	547	409	169	121	134	182	422	536	320	200	212	332	548	410	170	122
277	445	565	343	151	55	67	163	355	553	438	265	278	446	566	344	152	56	68	164	356	554	434	266
469	517	367	223	79	7	19	91	235	379	505	457	470	516	368	224	80	8	20	92	236	380	506	458
303	495	393	249	105	33	45	117	261	405	483	291	306	498	396	252	108	36	48	120	264	408	486	294
207	327	543	417	177	129	141	189	429	531	315	195	210	330	546	420	180	132	144	192	432	534	318	198
63	159	351	561	441	273	285	453	573	839	147	51	66	162	354	564	444	276	288	456	576	842	150	54
15	87	231	375	513	465	477	525	363	219	75	3	18	90	234	378	516	468	480	528	366	222	78	6
39	111	255	399	489	297	309	501	387	243	99	27	42	114	258	402	492	300	312	504	390	246	102	30
135	183	423	537	321	201	213	333	549	411	171	123	138	186	426	540	324	204	216	336	552	414	174	126
279	447	567	345	153	57	69	165	357	555	435	267	282	450	570	348	156	60	72	168	360	558	438	270
471	519	369	225	81	9	21	93	237	381	507	459	474	522	372	228	84	12	24	96	240	384	510	462

12mm'

12mm'

12mm'

FIG. 32

257	449	515	323	131	35	47	143	335	527	437	245	258	448	514	322	130	34	46	142	334	526	436	244
161	353	545	419	203	83	95	215	431	533	347	149	160	352	544	418	202	82	94	214	430	532	340	148
65	185	401	563	371	227	239	383	575	389	173	53	64	184	400	562	370	226	238	382	574	388	172	52
17	113	305	487	467	275	287	479	485	293	101	5	16	112	304	486	466	274	286	478	484	292	100	4
41	137	329	521	443	251	263	455	509	317	125	29	40	136	328	520	442	250	262	454	508	316	124	28
89	209	425	539	347	155	167	359	551	413	197	77	88	208	424	538	346	154	166	358	550	412	196	76
233	377	589	395	179	59	71	191	407	557	365	221	232	376	588	394	178	58	70	190	406	556	364	220
281	473	491	299	107	11	23	119	311	503	467	269	280	472	490	298	106	10	22	118	310	502	466	268
253	445	511	319	127	31	43	139	331	523	433	247	254	446	512	320	128	32	44	140	332	524	434	242
157	349	541	415	199	79	91	211	427	529	337	145	158	350	542	416	200	80	92	212	428	530	338	146
61	181	397	559	367	223	235	379	571	385	169	49	62	182	398	560	368	224	236	380	572	386	170	50
113	109	301	493	463	271	283	475	481	289	97	7	14	110	302	494	464	272	284	476	482	290	98	2
37	133	325	517	439	247	259	451	505	313	121	25	38	134	326	518	440	248	260	452	506	314	122	26
85	205	421	535	343	151	163	355	547	409	193	73	86	206	422	536	344	152	164	356	548	410	194	74
229	373	585	391	175	55	67	187	403	553	361	217	230	374	586	392	176	56	68	188	404	554	362	218
277	469	487	295	103	7	19	115	307	499	457	265	278	470	488	296	104	8	20	116	308	500	458	266
255	447	513	321	129	33	45	141	333	525	435	243	258	450	516	324	132	36	48	144	336	528	438	246
159	351	543	417	201	81	93	213	429	531	339	147	162	354	546	420	204	84	96	216	432	534	342	150
63	183	399	561	369	225	237	381	573	387	171	51	68	186	402	564	372	228	240	384	576	390	174	54
15	111	303	495	465	273	285	477	483	291	99	3	18	114	306	498	468	276	288	480	486	294	102	6
39	135	327	519	441	249	261	453	507	315	123	27	42	138	330	522	444	252	264	456	510	318	126	30
87	207	423	537	345	153	165	357	549	411	195	75	90	210	426	540	348	156	168	360	552	414	198	78
231	375	587	393	177	57	69	189	405	555	363	219	234	378	590	396	180	60	72	192	408	558	366	222
279	471	489	297	105	9	21	117	309	501	459	267	282	474	492	300	108	12	24	120	312	504	462	270

12nn'

12nn'

12n'

12nn'

FIG. 33

1200'

1200'

1200'

483	243	75	27	39	123	315	543	481	241	73	25	37	121	313	541	485	245	77	29	41	125	317	545
375	255	171	135	87	183	435	555	373	253	169	133	85	181	433	553	377	257	173	137	89	185	437	557
513	387	447	327	267	279	399	465	511	385	445	325	265	277	397	463	515	389	449	329	269	281	401	467
297	417	357	567	495	345	201	213	295	415	355	565	493	343	199	211	299	419	359	569	497	347	203	215
105	165	225	369	525	429	153	57	103	163	223	367	523	427	151	55	107	167	227	371	527	431	155	59
21	69	237	477	537	309	117	9	19	67	235	475	535	307	115	7	23	71	239	479	539	311	119	11
45	129	321	549	489	249	81	33	43	127	319	547	487	247	79	31	47	131	323	551	491	251	83	35
93	189	441	561	381	261	177	141	91	187	439	559	379	259	175	139	95	191	443	563	383	263	179	143
273	285	405	469	507	393	453	333	271	283	403	457	505	391	451	331	275	287	407	461	509	395	455	335
501	339	195	207	291	411	351	573	499	337	193	205	289	409	349	571	503	341	197	209	293	413	353	575
519	423	147	51	99	159	219	363	517	421	145	49	97	157	217	361	521	425	149	53	101	161	221	365
531	303	111	3	15	63	231	471	529	301	109	1	13	61	229	469	533	305	113	5	17	65	233	473
486	246	78	30	42	126	318	546	482	242	74	26	38	122	314	542	484	244	76	28	40	124	316	544
378	258	174	138	90	186	438	558	374	254	170	134	86	182	434	554	376	256	172	136	88	184	436	556
516	390	450	330	270	282	402	468	512	386	446	326	266	278	398	464	514	388	448	328	268	280	400	466
300	420	360	570	498	348	204	216	296	416	356	566	494	344	200	212	298	418	358	568	496	346	202	214
108	168	228	372	528	432	156	60	104	164	224	368	524	428	152	56	106	166	226	370	526	430	154	58
24	72	240	480	540	312	120	12	20	68	236	476	536	308	116	8	22	70	238	478	538	310	118	10
48	132	324	552	492	252	84	36	44	128	320	548	488	248	80	32	46	130	322	550	490	250	82	34
96	192	444	564	384	264	180	144	92	188	440	560	380	260	176	140	94	190	442	562	382	262	178	142
276	288	408	462	510	396	456	336	272	284	404	458	506	392	452	332	274	286	406	460	508	394	454	334
504	342	198	210	294	414	354	576	500	338	194	206	290	410	350	572	502	340	196	208	292	412	352	574
522	426	156	54	102	162	222	366	518	422	146	50	98	158	218	362	520	424	148	52	100	160	220	364
534	306	114	6	18	66	234	474	530	302	110	2	14	62	230	470	532	304	112	4	16	64	232	472

1200'

FIG. 34

The figure shows a grid of numbers arranged in rows and columns. There are three arrows pointing to specific rows, each labeled '12pp'. The grid contains the following numbers:

495	315	123	39	15	87	327	567	493	313	121	37	13	85	325	565	497	317	125	41	17	89	329	569
459	375	207	135	63	159	339	519	457	373	205	133	61	157	337	517	461	377	209	137	65	161	341	521
537	411	411	351	291	183	255	393	535	469	409	349	229	181	253	391	539	473	413	353	233	185	257	395
273	405	441	543	423	249	177	225	271	403	439	541	421	247	175	223	275	407	443	545	425	251	179	227
105	201	369	453	513	285	153	57	103	199	367	451	511	283	151	55	107	203	371	455	515	287	155	59
33	117	309	489	561	297	81	9	31	115	307	487	559	295	79	7	35	119	311	491	563	299	83	11
21	93	333	573	501	321	129	45	19	91	331	571	499	319	127	43	23	95	335	575	503	323	131	47
69	165	345	525	465	381	213	141	67	163	343	523	463	379	211	139	71	167	347	527	467	383	215	143
237	189	261	387	531	477	417	357	235	187	259	385	529	475	415	355	239	191	263	389	533	479	419	359
429	243	171	219	267	399	435	549	427	241	169	217	265	397	433	547	431	245	173	221	269	401	437	551
597	279	167	51	99	195	363	447	595	277	145	49	97	193	361	445	599	281	149	53	101	197	365	449
555	291	75	3	27	111	303	483	553	289	73	1	25	109	301	481	557	293	77	5	29	113	305	485
498	318	126	42	18	90	330	570	494	314	122	38	14	86	326	566	496	316	124	40	16	88	328	568
462	378	210	138	66	162	342	522	458	374	206	134	62	158	338	518	460	376	208	136	64	160	340	520
540	474	414	354	234	186	258	396	536	470	410	350	230	182	254	392	538	472	412	352	232	184	256	394
276	408	444	546	426	252	180	228	272	404	440	542	422	248	176	224	274	406	442	544	424	250	178	226
108	204	372	456	516	288	156	60	104	200	368	452	512	284	152	56	106	202	370	454	514	286	154	58
36	120	312	492	564	300	84	12	32	116	308	488	560	296	80	8	34	118	310	490	562	298	82	10
24	96	336	576	504	324	132	48	20	92	332	572	500	320	128	44	22	94	334	574	502	322	130	46
72	168	348	528	468	384	216	144	68	164	344	524	464	380	212	140	70	166	346	526	466	382	214	142
240	192	264	396	534	480	420	360	236	188	260	396	530	476	416	356	238	190	262	388	532	478	418	358
432	246	174	222	270	402	438	552	428	242	170	218	266	398	434	548	430	244	172	220	268	400	436	550
510	282	150	54	102	198	366	450	506	278	146	50	98	194	362	446	508	280	148	52	100	196	364	448
558	294	78	6	30	114	306	486	554	290	74	2	26	110	302	482	556	292	76	4	28	112	304	484

Arrows labeled '12pp' point to the first, second, and eighth rows of the grid.

FIG. 35

93	77	53	21	16	48	44	12	17	49	73	89
85	69	29	8	40	64	60	36	4	25	65	81
61	37	5	32	72	88	84	68	28	1	33	57
45	13	24	56	80	96	92	76	52	20	9	41
43	11	18	50	74	90	94	78	54	22	15	47
59	35	3	26	66	82	86	70	30	7	39	63
83	67	27	2	34	58	62	38	6	31	71	87
91	75	51	19	10	42	46	14	23	55	79	95

12aa

12a

FIG. 36

93	77	53	21	16	48	44	12	17	49	73	89
85	69	29	8	40	64	60	36	4	25	65	81
61	37	5	32	72	88	84	68	28	1	33	57
45	13	24	56	80	96	92	76	52	20	9	41
43	11	18	50	74	90	94	78	54	22	15	47
59	35	3	26	66	82	86	70	30	7	39	63
83	67	27	2	34	58	62	38	6	31	71	87
91	75	51	19	10	42	46	14	23	55	79	95

12aa

12a

PRINTING METHOD AND APPARATUS, AND BINARY-FORM DITHER MATRIX PATTERN

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a binary-form dither matrix pattern (dither pattern table) for use in converting continuous tone images (natural images, graphic images, colored characters, and others) into binary images—hereinafter this process will be also called “binary-coding”. The invention also relates to a printing method and a printing apparatus using the binary-form dither matrix pattern.

2. Description of the Related Art

When continuous tone images (natural images, graphic images, and colored characters), which are generated or input from input devices such as scanners, are output from output devices such as printers, the multilevel images must be converted into binary images, so that their continuous tone is expressed by ON/OFF of coloring materials (ink, toner, or the like).

Dithering is a well-known method of such conversion (binary-coding). In dithering, the value of one specific pixel (object pixel) of a continuous tone image (multilevel image) is compared with a predetermined threshold to decide the intensity level of the pixel. In accordance with this intensity level, the ON/OFF of the dot corresponding to the object pixel is determined using a binary-coding dither matrix pattern which has been prepared previously.

For example, Japanese Examined Patent Application Publication No. SHO 53-5561 discloses dither patterns that are tiled in such a way that the centroid of an area to which color materials are to be fixed is at an angle of $\tan\theta=1/3$ (approximately 18.43°). In this technique, a dither pattern is rotated at an angle other than 45° so as to avoid moire patterns or other artifacts (artificial striped patterns).

In the dither pattern of Japanese Examined Patent Application Publication No. SHO 53-5561, however, a unit pattern, which is generated by tiling the dither pattern, is composed of a small number (10) of pixels, and thus it is difficult to printout a high quality image of a large number of gray levels. More precisely, to handle images with 256 gray levels (8-bit coded image pixels), it is preferable to use a dither pattern which realizes a unit pattern composed of a larger number of pixels.

SUMMARY OF THE INVENTION

With the foregoing problems in view, one object of the present invention is to provide a binary-coding dither matrix pattern which is composed of a greater number of pixels and which can minimize moiré patterns and other artifacts in printouts.

Another object of the invention is to provide a printing method and apparatus employing the binary-coding dither matrix pattern.

In order to accomplish the above object, according to the present invention, there is provided a method of printing a given multivalued image in a binary-form output pattern, which method comprises the steps of: (a) providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pixels that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which groups are

substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; and (b) forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

Further, there is provided a method of printing a given multivalued image in a binary-form output pattern, which method comprises the steps of: (a) providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; (b) expanding the given multivalued image in a memory area of a storage device; and (c) forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image which has been expended in the memory area, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

Still further, there is provided an apparatus for printing a given multivalued image in a binary-form output pattern, which apparatus comprises: (a) means for providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which dot elements are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; (b) a storage device having a memory area in which the given multivalued image is to be expanded; and (c) means for forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image which has been expended in the memory area, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

Furthermore, there is provided an apparatus for printing a given multivalued image in a binary-form output pattern, which apparatus comprises: (a) means for providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which dot elements are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; and (b) means for forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

Further, there is provided a binary-form dither matrix pattern for use in printing a given multivalued image in a binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group.

As a preferred feature, the rectangular pattern may be composed of 96 pattern elements arranged in a matrix of 8 rows×12 columns that are turned on in the following manner: the 1st to 12th pattern elements composing the first row of the rectangular pattern are turned on 4th, 20th, 44th, 76th, 81st, 49th, 53rd, 85th, 80th, 48th, 24th, and 8th, respectively; the 1st to 12th pattern elements composing the second row of the rectangular pattern are turned on 12th, 28th, 68th, 89th, 57th, 33rd, 37th, 61st, 93rd, 72nd, 32nd, and 16th, respectively; the 1st to 12th pattern elements composing the third row of the rectangular pattern are turned on 36th, 60th, 92nd, 65th, 25th, 9th, 13th, 29th, 69th, 96th, 64th, and 40th, respectively; the 1st to 12th pattern elements composing the fourth row of the rectangular pattern are turned on 52nd, 84th, 73rd, 41st, 17th, 1st, 5th, 21st, 45th, 77th, 88th, and 56th, respectively; the 1st to 12th pattern elements composing the fifth row of the rectangular pattern are turned on 54th, 86th, 79th, 47th, 23rd, 7th, 3rd, 19th, 43rd, 75th, 82nd, and 50th, respectively; the 1st to 12th pattern elements composing the sixth row of the rectangular pattern are turned on 38th, 62nd, 94th, 71st, 31st, 15th, 11th, 27th, 67th, 90th, 58th, and 34th, respectively; the 1st to 12th pattern elements composing the seventh row of the rectangular pattern are turned on 14th, 30th, 70th, 95th, 63rd, 39th, 35th, 59th, 91st, 66th, 26th, and 10th, respectively; and the 1st to 12th pattern elements composing the eighth row of the rectangular pattern are turned on 6th, 22nd, 46th, 78th, 87th, 55th, 51st, 83rd, 74th, 42nd, 18th, and 2nd, respectively.

As another preferred feature, the order of turning-on set for an arbitrary pattern element in said rectangular pattern

and that set for the pattern element disposed in a position diametrically symmetrical to said arbitrary pattern element with respect to the center of said rectangular pattern are substituted for each other.

A printing method and apparatus, and a binary-form dither matrix pattern of the present invention guarantee the following advantageous results:

(1) The sequence of turning on a plurality of pattern elements in the binary-form dither matrix pattern is set in such a way that a plurality of groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group. Such a binary-form dither matrix pattern is used to binarize a given multilevel image, and an output image is formed based on the binarization result. As a result, moiré patterns and other artifacts are minimized in printouts.

(2) Even if the order of turning-on set for an arbitrary pattern element in said rectangular pattern and that set for the pattern element disposed in a position diametrically symmetrical to said arbitrary pattern element with respect to the center of said rectangular pattern are substituted for each other, it is still possible to minimize moiré patterns and other artifacts.

(3) Even if said rectangular pattern for which the sequence of turning-on is set is angularly moved about the pattern center by 90°, clockwise or counterclockwise, it is still possible to minimize moiré patterns and other artifacts.

(4) Even if the sequence of turning on said plural pattern elements is changed using a look-up table, it is still possible to minimize moiré patterns and other artifacts.

Other objects and further features of the present invention will be apparent from the following detailed description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing the essential part of dot generating unit 1 of a printing apparatus according to one preferred embodiment of the present invention;

FIG. 2(a) is a view illustrating an example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment, and FIG. 2(b) also illustrates an example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment, in which binary-form dither matrix pattern a unit pattern is shown as a diagonally shaded area;

FIG. 3 is an example of one-dimensional look-up table used in a printing apparatus of the embodiment;

FIG. 4 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 5 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 6 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 7 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 8 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 9 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

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FIG. 10 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 11 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 12 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 13 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 14 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 15 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 16 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 17 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 18 is a modified example of a binary-form dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 19 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 20 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 21 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 22 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 23 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 24 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 25 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 26 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 27 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 28 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 29 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 30 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 31 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

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FIG. 32 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 33 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 34 is another modified example of a binary-coding dither matrix pattern used in a printing apparatus of the embodiment;

FIG. 35 is a view for describing binary-coding processing carried out in a printing apparatus of the embodiment; and

FIG. 36 is a view for describing binary-coding processing carried out in a printing apparatus of the embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

One preferred embodiment of the present invention will be hereinafter described with reference to the relevant accompanying drawings.

FIG. 1 depicts the essential part of dot generating unit 1 of a printing apparatus (hereinafter called a printer) according to one preferred embodiment of the present invention.

The present printer converts a multi-level image (continuous tone image) into a binary image—hereinafter this conversion will also be called “binary-coding”—using a binary-coding dither matrix pattern (binary-form dither matrix pattern; described later in detail). On the basis of the resulting binary image, the ON/OFF of coloring material is controlled to form (print) an output image. The printer controls the size of tiny dots (halftone dots) of coloring material to reproduce various shades of color of a continuous tone image on the surface of a paper sheet, film, or printing plate. In other words, gray levels of the image are represented by the proportion each dot occupies in a unit area.

The present printer (for example, an inkjet printer, a laser beam printer, a thermal transfer printer, dye-sublimation printer, and an LED printer) forms (prints) an image on a medium (for example, a print sheet) by forming (making marks) color materials (toner, ink, and so on) on the medium. In the present printer, different shades of gray in a multilevel image (continuous tone image) are reproduced as different areas of color materials (dots).

In the present embodiment, the pixels to be binarized have pixel values of 0 to 255 (multilevel) while the pixels after being binarized have pixel values of 0 or 255 (binary). This definition would never affect the generality of the description.

The present printer has a CPU (Central Processing Unit), a ROM (Read Only Memory), and RAM (Random Access Memory) (all of these are not shown). The ROM stores application programs (binarizing program and printing program) for realizing color operation unit 10, gradation characteristics changing unit 13, and dot data generating unit 14 (these will be described later). The CPU executes the above application programs stored in the ROM, thereby serving as color operation unit 10, gradation characteristics changing unit 13, and dot data generating unit 14 (their detailed descriptions will be given later), so that the printing method and the printing apparatus of the present invention are realized.

In the present description, the term “computer” designates a concept including hardware and an operation system, that is, it designates hardware tools controlled by an operation system. In a case where an application program singly operates hardware without the necessity of an operation

system, the hardware itself corresponds to the computer. The hardware should have at least one microprocessor, such as a CPU, and a means for reading out a computer program stored in a recording medium.

Here, programs (binarizing program and printing program) for realizing the functions of color operation unit **10**, gradation characteristics changing unit **13**, and dot data generating unit **14**, are stored in a computer-readable recording medium, such as a flexible disk, CD-ROM, CD-R, CD-R/W, DVD, DVD-R, DVD-R/W, magnetic disk, optical disk, and magneto-optical disk, to be provided to users. A computer reads out the programs stored in the medium, and transmits the read-out programs to an internal or an external storage. The programs recorded in a storage device (recording medium), such as a magnetic disk, optical disk, and magneto-optical disk, may otherwise be provided to the computer via communications networks.

A microprocessor (the CPU of the printer in the present embodiment) of the computer executes the programs stored in an internal storage device (the RAM or ROM of the printer in the present embodiment), thereby serving as color operation unit **10**, gradation characteristics changing unit **13**, and dot data generating unit **14**. At that time, the computer may otherwise read out the programs stored in a recording medium.

In the present embodiment, the term "computer" designates a concept including hardware and an operation system, that is, it designates hardware tools controlled by an operation system. In a case where an application program singly operates hardware with no necessity for any operation system, the hardware itself corresponds to the computer. The hardware should have at least one microprocessor, such as a CPU, and a means for reading out a computer program stored in a recording medium. Concretely, image forming apparatus **10a** serves as a computer in the present embodiment.

Further, as a recording medium of the present embodiment, there can be employed various types of computer-readable media such as an IC card, ROM cartridge, magnetic tape, punch card, internal storage device (a memory such as a RAM and ROM), external storage device, and bar-coded printout, in addition to a flexible disk, CD-ROM, CD-R, CD-R/W, DVD, DVD-R, DVD-R/W, magnetic disk, optical disk, and magneto-optical disk, as cited above.

Dot generating unit **1** generates dots on the surface of a paper sheet, film, or printing plate, based on image signals of a continuous tone image. Dot generating unit **1** includes color operation unit **10**, image signal memory (storage area) **11**, pattern memory (binary-form dither matrix pattern setting means) **12**, gradation characteristics changing unit **13**, dot data generating unit (selected binary-form pattern generating means) **14**, and image forming unit **15**.

Color operation unit **10** performs color operations on image signals of a continuous tone image. Various types of processing, such as color correction, gradation correction, black printer formation, under color removal, and sharpness enhancement, are performed on input image signals (represented by, for example, pixel values ranging from 0 to 255).

Image signal memory **11** stores image signals which have been processed by color operation unit **10**, thereby functioning as a memory area in which a continuous tone image is to be expanded.

Pattern memory **12** stores a binary-form dither matrix pattern (hereinafter also called "binary-coding pattern") as shown in FIG. 2(a). Practically, pattern memory **12** and a recording medium (not shown), such as a RAM, a ROM, and a magnetic storage device, store a binarizing program and a

printing program, and hence it can be considered that pattern memory **12** stores binary-coding pattern **12a**. FIG. 2(b) shows an example of a binary coding pattern (binary-form dither matrix pattern) for use in a printer of one embodiment of the present invention, and its unit pattern (described later) is shown as a diagonally shaded area.

As shown in FIG. 2(a), binary-coding pattern **12a** is a rectangular pattern composed of pixels (pattern elements) arranged in a matrix, which pixels are either turned on (making them black) or turned off (leaving them white). The sequence of turning on the pixels is set in such a way that plural dots (output dots), which are substantially identical in shape, grow from respective local points (the center and the four corners of binary-coding pattern **12a** in FIG. 2(a)).

To be more specific, binary-coding pattern **12a** is composed of 96 pixels arranged in a matrix of 8 rows×12 columns (rectangular pattern) as shown in FIG. 2(a) and FIG. 2(b). The sequence of turning on the pixels is set in such a way that each dot grows keeping a roughly round shape. In unit pattern **12aa** (the diagonally shaded part in FIG. 2(b); described later) in binary-coding pattern **12a**, two pixels that are disposed diametrically symmetrically to one another with respect to the center of the rectangular pattern, that is, the pixel numbered **96** and that numbered **94**, are first turned on successively in this order. In binary-coding pattern **12a** of FIG. 2, (a) and (b), the 96 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 12th pixels composing the first row of the rectangular pattern are numbered **93, 77, 53, 21, 16, 48, 44, 12, 17, 49, 73, and 89**, respectively;

(2) the 1st to 12th pixels composing the second row of said rectangular pattern are numbered **85, 69, 29, 8, 40, 64, 60, 36, 4, 25, 65, and 81**, respectively;

(3) the 1st to 12th pixels composing the third row of said rectangular pattern are numbered **61, 37, 5, 32, 72, 88, 84, 68, 28, 1, 33, and 57**, respectively;

(4) the 1st to 12th pixels composing the fourth row of said rectangular pattern are numbered **45, 13, 24, 56, 80, 96, 92, 76, 52, 20, 9, and 41**, respectively;

(5) the 1st to 12th pixels composing the fifth row of said rectangular pattern are numbered **43, 11, 18, 50, 74, 90, 94, 78, 54, 22, 15, and 47**, respectively;

(6) the 1st to 12th pixels composing the sixth row of said rectangular pattern are numbered **59, 35, 3, 26, 66, 82, 86, 70, 30, 7, 39, and 63**, respectively;

(7) the 1st to 12th pixels composing the seventh row of said rectangular pattern are turned on **83, 67, 27, 2, 34, 58, 62, 38, 6, 31, 71, and 87**, respectively; and

(8) the 1st to 12th pixels composing the eighth row of said rectangular pattern are turned on **91, 75, 51, 19, 10, 42, 46, 14, 23, 55, 79, and 95**, respectively.

In other words, the sequence of turning on the 96 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 12th pixels composing the first row of the rectangular pattern are turned on 4th, 20th, 44th, 76th, 81st, 49th, 53rd, 85th, 80th, 48th, 24th, and 8th, respectively;

(2) the 1st to 12th pixels composing the second row of the rectangular pattern are turned on 12th, 28th, 68th, 89th, 57th, 33rd, 37th, 61st, 93rd, 72nd, 32nd, and 16th, respectively;

(3) the 1st to 12th pixels composing the third row of the rectangular pattern are turned on 36th, 60th, 92nd, 65th, 25th, 9th, 13th, 29th, 69th, 96th, 64th, and 40th, respectively;

(4) the 1st to 12th pixels composing the fourth row of the rectangular pattern are turned on 52nd, 84th, 73rd, 41st, 17th, 1st, 5th, 21st, 45th, 77th, 88th, and 56th, respectively;

(5) the 1st to 12th pixels composing the fifth row of the rectangular pattern are turned on 54th, 86th, 79th, 47th, 23rd, 7th, 3rd, 19th, 43rd, 75th, 82nd, and 50th, respectively;

(6) the 1st to 12th pixels composing the sixth row of the rectangular pattern are turned on 38th, 62nd, 94th, 71st, 31st, 15th, 11th, 27th, 67th, 90th, 58th, and 34th, respectively;

(7) the 1st to 12th pixels composing the seventh row of the rectangular pattern are turned on 14th, 30th, 70th, 95th, 63rd, 39th, 35th, 59th, 91st, 66th, 26th, and 10th, respectively; and

(8) the 1st to 12th pixels composing the eighth row of the rectangular pattern are turned on 6th, 22nd, 46th, 78th, 87th, 55th, 51st, 83rd, 74th, 42nd, 18th, and 2nd, respectively.

In binary-coding pattern **12a** of FIG. 2, (a) and (b), the turning on of the pixels is carried out in descending numeric order, and thereby binary-coding pattern **12a** functions as a dot clustered binary-coding pattern (binary-form dither matrix pattern; dither pattern).

Binary-coding pattern **12a** is created in the following manner. A main pattern (rectangular pattern) composed of the pixels arranged in a matrix of 8 rows×12 columns is created. This main pattern can be subdivided into four tiled sub-patterns, two in the longitudinal direction by two in the width direction. Each of the sub-patterns is composed of 24 pixels arranged in a matrix of 4 rows×6 columns. The sequence of turning on the pixels is set in the following way, thereby creating binary-coding pattern **12a**. In one of the sub-patterns, a pixel (not yet turned on) that is closest to a predetermined position (the center position of the main pattern in the present embodiment) in the main pattern and that is also adjacent to a turned-on pixel, if any, is turned on. After that, the turning-on process progresses to another one of the sub-patterns that is disposed symmetrically to the previous sub-pattern, which includes the pixel having been turned on most recently, with respect to the predetermined position. In this sub-pattern, a pixel which is disposed in a position corresponding to the most-recently-turned-on pixel is then turned on. These steps of turning-on processing will be repeated.

With use of binary-coding pattern **12a**, it is possible to represent the pixel values (e.g., 0 to 255) of the individual pixels of an object multilevel image (original image) in 96 levels of gray.

In binary-coding pattern **12a**, a single dot is composed of 40 pixels (the diagonally shaded part in FIG. 2) which are turned on 16th, 48th, 44th, 12th, 8th, 40th, 64th, 60th, 36th, 4th, 32nd, 72nd, 88th, 84th, 68th, 28th, 24th, 56th, 80th, 96th, 92nd, 76th, 52nd, 20th, 18th, 50th, 74th, 90th, 94th, 78th, 54th, 22nd, 26th, 66th, 82nd, 86th, 70th, 30th, 2nd, 34th, 58th, 62nd, 38th, 6th, 10th, 42nd, 46th, and 14th, respectively. Note that the numbers given to the pixels in the drawings indicate the positions of the respective pixels in the sequence of their being turned on. A group of pixels constituting a single output dot is called a unit pattern **12aa**.

Using this unit pattern **12aa**, it is possible to form output dots of 40 different sizes, from the smallest one in which only one of the pixels is turned on to the largest one in which all of the pixels are turned on.

This indicates that binary-coding pattern **12a** allows a single dot to represent 40 differing levels of gray.

Gradation characteristics changing unit **13** converts the pixel value of each pixel of input image signals in accordance with a one-dimensional lookup table (see FIG. 3), which has been prepared in advance. FIG. 3 shows an

example of the one-dimensional lookup table to be used by a printer of one embodiment of the present invention. Gradation characteristics changing unit **13** uses such a one-dimensional lookup table as shown in FIG. 3 to convert the pixel values of the pixels of input image signals, and transfers the resulting converted pixel values to data generating unit **14**, thereby changing the turning-on sequence of output pixels (the printer pixels). In this manner, gradation characteristics changing unit **13** serves as a turning-on sequence changing section for changing the sequence of turning on the output pixels according to the look-up table.

At that time, using this lookup table, color material may be fixed concurrently onto plural pixels of binary-coding pattern **12a**. Or otherwise, the color material may not be fixed.

Further, when changing the turning-on sequence based on the lookup table, the sequence may be set in such a way that color material is fixed onto a pixel adjacent to any turned-on pixel, onto which color material has already been fixed. As a result, the fixing of color material is facilitated, guaranteeing the improved quality of printed output.

Still further, though gradation characteristics changing unit **13** converts the pixel values of the input image signals according to the lookup table of FIG. 3 in the present embodiment, the present invention should by no means be limited to this, and various changes or modifications may be suggested without departing from the gist of the invention. For example, any other lookup table than that of FIG. 3 may be used by gradation characteristics changing unit **13**, or the changing of the pixel values by gradation characteristics changing unit **13** may be omitted.

Dot data generating unit (binarizing unit) **14** converts multi-level image signals input from gradation characteristics changing unit **13** into binary form using binary-coding pattern **12a** stored in pattern memory **12** so as to obtain data (dot data) for use in printing dots by image forming unit **15**.

More precisely, dot data generating unit **14** compares the pixel value of each pixel of input image signals (for example, ranging from 0 through 255) with the threshold having been previously determined to obtain the number of output pixels which are to be turned on. After determining the to-be-turned-on number, dot data generating unit **14** generates dot data such that as many output pixels as the obtained number are turned on in accordance with the turning-on sequence set in binary-coding pattern **12a**.

That is, dot data generating unit **14** selects (turns on) the pixels of binary-coding pattern **12a** in accordance with the turning-on sequence set for the binary-coding pattern **12a**. In FIG. 2(a) and FIG. 2(b), the pixels are selected (turned on) in descending numeric order, beginning from the start pixel (the pixel numbered **96**) until the obtained to-be-turned-on number of pixels are turned on.

Image forming unit **15** prints the dot data generated by dot data generating unit **14**. In an electrostatic printer, for example, an exposure device serves as image forming unit **15**, and in that case, the data for use in exposure generated by dot data generating unit **14** serves as the dot data.

That is, dot data generating unit **14** converts the multi-level image expanded on image signal memory **11** into binary form, and image forming unit **15** forms an output image based on the conversion results.

In dot generating unit **1** of a printer of one embodiment of the present invention, binary-coding pattern **12a** of FIG. 2(a) is prepared/provided in pattern memory **12** (providing step). Color operation unit **10** performs various types of processing, such as color correction, gradation correction, black printer formation, under color removal, and sharpness

enhancement, on input image signals, and the resulting image signal is then expanded in image signal memory 11 (the expanding step for expanding a given multilevel image in a memory area). Gradation characteristics changing unit 13 of the printer performs pixel value conversion on the image signals expanded in image signal memory 11, as necessary.

After that, dot data generating unit 14 converts the image signal into binary form (binarizing step) using binary-coding pattern 12a stored in pattern memory 12, to create dot data, which is then input to image forming unit 15.

FIG. 35 and FIG. 36 are views for describing binary-coding processing carried out in a printer of one embodiment of the present invention. These views show an example of the process of determining the pixels on which color material is to be formed. In FIG. 35, five pixels of binary-coding pattern 12a are turned on; in FIG. 26, twenty pixels of binary-coding pattern 12a are turned on. In these drawings, the selected (turned on) pixels are marked with circles.

As shown in FIG. 35 and FIG. 36, dot data generating unit 14 selects the pixels of binary-coding pattern 12a in accordance with the given turning-on sequence (in descending numerical order in the present embodiment), from the start pixel to the pixel which is given a predetermined sequence number, so that the pixels on which color material is to be formed are determined, thereby generating dot data. In accordance with the thus generated dot data, image forming unit 15 forms (prints) the image (image forming step).

In this manner, with a printer (binary-form dither matrix pattern) of one embodiment of the present invention, since dot-cluster-type printing is realized, it is possible to minimize moiré and other artifacts (artificial striped patterns) in printed output.

Further, since binary-coding pattern 12a is a rectangular pattern of 8×12 pixels, pattern memory 12 needs less capacity for recording binary-coding pattern 12a, so that binary-coding processing is increased in speed, and manufacturing costs of the printer can be reduced.

The present invention should by no means be limited to the above-illustrated embodiment, and various changes or modifications may be suggested without departing from the gist of the invention.

For example, though dot data generating unit 14 uses binary-coding pattern 12a of FIG. 2(a) in binary-coding processing, the present invention should by no means be limited to this, and various changes or modifications may be suggested without departing from the gist of the invention. FIGS. 4 through 18 show modified examples of binary-form dither matrix patterns used in a printing apparatus of one embodiment of the present invention. Dot data generating unit 14 can use any of binary-coding pattern 12b through binary-coding pattern 12p of FIG. 4 through FIG. 18, respectively, in binary-coding processing. Using binary-coding patterns 12b through 12h, it is possible to represent the pixel values (e.g., 0 to 255) of the pixels of an object multilevel image (original image) in 96 levels of gray. Using binary-coding pattern 12i through 12p, it is possible to represent the pixel values of the pixels of an object multilevel image (original image) in 576 levels of gray. For the sake of convenience, some of the unit patterns are diagonally shaded in FIG. 4 through FIG. 18.

Binary-coding pattern 12b of FIG. 4 is composed of 96 pixels arranged in a matrix of 8 rows×12 columns, and the sequence of turning on the pixels is set in such a way that dots grow keeping a roughly oval shape (the degree of flattening≈0.8). In unit pattern 12bb of binary-coding pattern 12b, two pixels that are disposed diametrically symmetri-

cally to one another with respect to the center of the rectangular pattern, that is, the pixel numbered 96 and that numbered 94, are first turned on successively in this order. In binary-coding pattern 12b of FIG. 4, the 96 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 12th pixels composing the first row of the rectangular pattern are numbered 93, 77, 45, 13, 24, 56, 52, 20, 9, 41, 73, and 89, respectively;

(2) the 1st to 12th pixels composing the second row of the rectangular pattern are numbered 85, 61, 29, 8, 40, 72, 68, 36, 4, 25, 57, and 81, respectively;

(3) the 1st to 12th pixels composing the third row of the rectangular pattern are numbered 69, 37, 5, 32, 64, 88, 84, 60, 28, 1, 33, and 65, respectively;

(4) the 1st to 12th pixels composing the fourth row of the rectangular pattern are numbered 53, 21, 16, 48, 80, 96, 92, 76, 44, 12, 17, and 49, respectively;

(5) the 1st to 12th pixels composing the fifth row of the rectangular pattern are numbered 51, 19, 10, 42, 74, 90, 94, 78, 46, 14, 23, and 55, respectively;

(6) the 1st to 12th pixels composing the sixth row of the rectangular pattern are numbered 67, 35, 3, 26, 58, 82, 86, 62, 30, 7, 39, and 71, respectively;

(7) the 1st to 12th pixels composing the seventh row of the rectangular pattern are numbered 83, 59, 27, 2, 34, 66, 70, 38, 6, 31, 63, and 87, respectively; and

(8) the 1st to 12th pixels composing the eighth row of the rectangular pattern are numbered 91, 75, 43, 11, 18, 50, 54, 22, 15, 47, 79, and 95, respectively.

In other words, the sequence of turning on the 96 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 12th pixels composing the first row of the rectangular pattern are turned on 4th, 20th, 52nd, 84th, 73rd, 41st, 45th, 77th, 88th, 56th, 24th, and 8th, respectively;

(2) the 1st to 12th pixels composing the second row of the rectangular pattern are turned on 12th, 36th, 68th, 89th, 57th, 25th, 29th, 61st, 93rd, 72nd, 40th, and 16th, respectively;

(3) the 1st to 12th pixels composing the third row of the rectangular pattern are turned on 28th, 60th, 92nd, 65th, 33rd, 9th, 13th, 37th, 69th, 96th, 64th, and 32nd, respectively;

(4) the 1st to 12th pixels composing the fourth row of the rectangular pattern are turned on 44th, 76th, 81st, 49th, 17th, 1st, 5th, 21st, 53rd, 85th, 80th, and 48th, respectively;

(5) the 1st to 12th pixels composing the fifth row of the rectangular pattern are turned on 46th, 78th, 87th, 55th, 23rd, 7th, 3rd, 19th, 51st, 83rd, 74th, and 42nd, respectively;

(6) the 1st to 12th pixels composing the sixth row of the rectangular pattern are turned on 30th, 62nd, 94th, 71st, 39th, 15th, 11th, 35th, 67th, 90th, 58th, and 26th, respectively;

(7) the 1st to 12th pixels composing the seventh row of the rectangular pattern are turned on 14th, 38th, 70th, 95th, 63rd, 31st, 27th, 59th, 91st, 66th, 34th, and 10th, respectively; and

(8) the 1st to 12th pixels composing the eighth row of the rectangular pattern are turned on 6th, 22nd, 54th, 86th, 79th, 47th, 43rd, 75th, 82nd, 50th, 18th, and 2nd, respectively.

Binary-coding pattern 12c of FIG. 5 is composed of 96 pixels arranged in a matrix of 12 rows×8 columns, and the sequence of turning on the pixels is set in such a way that dots having a roughly round shape grow substantially from the midpoint of each side of the rectangular pattern. In binary-coding pattern 12c, two pixels (the pixel numbered 96 and that numbered 94) that are disposed diametrically

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symmetrically to one another with respect to the center of the rectangular pattern (or the center of unit pattern **12cc** which is formed when binary-coding patterns **12c** are tiled both vertically and horizontally) are first turned on successively in this order. In binary-coding pattern **12c** of FIG. 5, the 96 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 8th pixels composing the first row of the rectangular pattern are numbered **14, 50, 82, 90, 94, 74, 42, and 2**, respectively;

(2) the 1st to 8th pixels composing the second row of the rectangular pattern are numbered **30, 54, 66, 78, 86, 70, 22, and 6**, respectively;

(3) the 1st to 8th pixels composing the third row of the rectangular pattern are numbered **11, 34, 26, 46, 58, 62, 38, and 19**, respectively;

(4) the 1st to 8th pixels composing the fourth row of the rectangular pattern are numbered **47, 27, 35, 10, 18, 39, 63, and 59**, respectively;

(5) the 1st to 8th pixels composing the fifth row of the rectangular pattern are numbered **79, 67, 55, 31, 7, 23, 71, and 87**, respectively;

(6) the 1st to 8th pixels composing the sixth row of the rectangular pattern are numbered **91, 83, 51, 15, 3, 43, 75, and 95**, respectively;

(7) the 1st to 8th pixels composing the seventh row of the rectangular pattern are numbered **93, 73, 41, 1, 13, 49, 81, and 89**, respectively;

(8) the 1st to 8th pixels composing the eighth row of the rectangular pattern are numbered **85, 69, 21, 5, 29, 53, 65, and 77**, respectively;

(9) the 1st to 8th pixels composing the ninth row of the rectangular pattern are numbered **57, 61, 37, 20, 12, 33, 25, and 45**, respectively;

(10) the 1st to 8th pixels composing the tenth row of the rectangular pattern are numbered **17, 40, 64, 60, 48, 28, 36, and 9**, respectively;

(11) the 1st to 8th pixels composing the eleventh row of the rectangular pattern are numbered **8, 24, 72, 88, 80, 68, 56, and 32**, respectively; and

(12) the 1st to 8th pixels composing the twelfth row of the rectangular pattern are numbered **4, 44, 76, 96, 92, 84, 52, and 16**, respectively.

In other words, the sequence of turning on the 96 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 8th pixels composing the first row of the rectangular pattern are turned on **83rd, 47th, 15th, 7th, 3rd, 23rd, 55th, and 95th**, respectively;

(2) the 1st to 8th pixels composing the second row of the rectangular pattern are turned on **67th, 43rd, 31st, 19th, 11th, 27th, 75th, and 91st**, respectively;

(3) the 1st to 8th pixels composing the third row of the rectangular pattern are turned on **86th, 63rd, 71st, 51st, 39th, 35th, 59th, and 78th**, respectively;

(4) the 1st to 8th pixels composing the fourth row of the rectangular pattern are turned on **50th, 70th, 62nd, 87th, 79th, 58th, 34th, and 38th**, respectively;

(5) the 1st to 8th pixels composing the fifth row of the rectangular pattern are turned on **18th, 30th, 42nd, 66th, 90th, 74th, 26th, and 10th**, respectively;

(6) the 1st to 8th pixels composing the sixth row of the rectangular pattern are turned on **6th, 14th, 46th, 82nd, 94th, 54th, 22nd, and 2nd**, respectively;

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(7) the 1st to 8th pixels composing the seventh row of the rectangular pattern are turned on **4th, 24th, 56th, 96th, 84th, 48th, 16th, and 8th**, respectively;

(8) the 1st to 8th pixels composing the eighth row of the rectangular pattern are turned on **12th, 28th, 76th, 92nd, 68th, 44th, 32nd, and 20th**, respectively;

(9) the 1st to 8th pixels composing the ninth row of the rectangular pattern are turned on **40th, 36th, 60th, 77th, 85th, 64th, 72nd, and 52nd**, respectively;

(10) the 1st to 8th pixels composing the tenth row of the rectangular pattern are turned on **80th, 57th, 33rd, 37th, 49th, 69th, 61st, and 88th**, respectively;

(11) the 1st to 8th pixels composing the eleventh row of the rectangular pattern are turned on **89th, 73rd, 25th, 9th, 17th, 29th, 41st, and 65th**, respectively; and

(12) the 1st to 8th pixels composing the twelfth row of the rectangular pattern are turned on **93rd, 53rd, 21st, 1st, 5th, 13th, 45th, and 81st**, respectively.

Binary-coding pattern **12d** of FIG. 6 is composed of 96 pixels arranged in a matrix of 12 rows×8 columns, and the sequence of turning on the pixels is set in such a way that dots having a roughly oval shape (the degree of flattening=0.8) grow substantially from the midpoint of each side of the rectangular pattern. In binary-coding pattern **12d**, two pixels (the pixel numbered **96** and that numbered **94**) that are disposed diametrically symmetrically to one another with respect to the center of the rectangular pattern (or the center of unit pattern **12dd** which is formed when binary-form dither matrix patterns **12d** are tiled both vertically and horizontally) are first turned on successively in this order. The 96 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 8th pixels composing the first row of the rectangular pattern are numbered **14, 38, 74, 90, 94, 82, 42, and 2**, respectively;

(2) the 1st to 8th pixels composing the second row of the rectangular pattern are numbered **18, 34, 62, 78, 86, 70, 46, and 10**, respectively;

(3) the 1st to 8th pixels composing the third row of the rectangular pattern are numbered **7, 22, 26, 50, 58, 66, 54, and 31**, respectively;

(4) the 1st to 8th pixels composing the fourth row of the rectangular pattern are numbered **51, 27, 23, 6, 30, 55, 67, and 59**, respectively;

(5) the 1st to 8th pixels composing the fifth row of the rectangular pattern are numbered **79, 63, 35, 19, 11, 47, 71, and 87**, respectively;

(6) the 1st to 8th pixels composing the sixth row of the rectangular pattern are numbered **91, 75, 39, 15, 3, 43, 83, and 95**, respectively;

(7) the 1st to 8th pixels composing the seventh row of the rectangular pattern are numbered **93, 81, 41, 1, 13, 37, 73, and 89**, respectively;

(8) the 1st to 8th pixels composing the eighth row of the rectangular pattern are numbered **85, 69, 45, 9, 17, 33, 61, and 77**, respectively;

(9) the 1st to 8th pixels composing the ninth row of the rectangular pattern are numbered **57, 65, 53, 32, 8, 21, 25, and 49**, respectively;

(10) the 1st to 8th pixels composing the tenth row of the rectangular pattern are numbered **29, 56, 68, 60, 52, 28, 24, and 5**, respectively;

(11) the 1st to 8th pixels composing the eleventh row of the rectangular pattern are numbered **12, 48, 72, 88, 80, 64, 36, and 20**, respectively; and

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(12) the 1st to 8th pixels composing the twelfth row of the rectangular pattern are numbered **4, 44, 84, 96, 92, 76, 40, and 16**, respectively.

In other words, the sequence of turning on the 96 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 8th pixels composing the first row of the rectangular pattern are turned on 83rd, 59th, 23rd, 7th, 3rd, 15th, 55th, and 95th, respectively;

(2) the 1st to 8th pixels composing the second row of the rectangular pattern are turned on 79th, 63rd, 35th, 19th, 11th, 27th, 51st, and 87th, respectively;

(3) the 1st to 8th pixels composing the third row of the rectangular pattern are turned on 90th, 75th, 71st, 47th, 39th, 31st, 43rd, and 66th, respectively;

(4) the 1st to 8th pixels composing the fourth row of the rectangular pattern are turned on 46th, 70th, 74th, 91st, 67th, 42nd, 30th, and 38th, respectively;

(5) the 1st to 8th pixels composing the fifth row of the rectangular pattern are turned on 18th, 34th, 62nd, 78th, 86th, 50th, 26th, and 10th, respectively;

(6) the 1st to 8th pixels composing the sixth row of the rectangular pattern are turned on 6th, 22nd, 58th, 82nd, 94th, 54th, 14th, and 2nd, respectively;

(7) the 1st to 8th pixels composing the seventh row of the rectangular pattern are turned on 4th, 16th, 56th, 96th, 84th, 60th, 24th, and 8th, respectively;

(8) the 1st to 8th pixels composing the eighth row of the rectangular pattern are turned on 12th, 28th, 52nd, 88th, 80th, 64th, 36th, and 20th, respectively;

(9) the 1st to 8th pixels composing the ninth row of the rectangular pattern are turned on 40th, 32nd, 44th, 65th, 89th, 76th, 72nd, and 48th, respectively;

(10) the 1st to 8th pixels composing the 10th row of the rectangular pattern are turned on 68th, 41st, 29th, 37th, 45th, 69th, 73rd, and 92nd, respectively;

(11) the 1st to 8th pixels composing the 11th row of the rectangular pattern are turned on 85th, 49th, 25th, 9th, 17th, 33rd, 61st, and 77th, respectively; and

(12) the 1st to 8th pixels composing the twelfth row of the rectangular pattern are turned on 93rd, 53rd, 13th, 1st, 5th, 21st, 57th, and 81st, respectively.

Binary-coding pattern **12e** of FIG. 7 is composed of 96 pixels arranged in a matrix of 8 rows×12 columns, and the sequence of turning on the pixels is set in such a way that dots grow keeping a roughly round shape. In unit pattern **12ee** of binary-coding pattern **12e**, two pixels (the pixel numbered **96** and that numbered **94**) that adjoin one another and are disposed adjacently to the center of the rectangular pattern, are first turned on successively in this order. The 96 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 12th pixels composing the first row of the rectangular pattern are numbered **89, 77, 53, 29, 16, 48, 46, 14, 31, 55, 79, and 91**, respectively;

(2) the 1st to 12th pixels composing the second row of the rectangular pattern are numbered **73, 65, 25, 8, 44, 64, 62, 42, 6, 27, 67, and 75**, respectively;

(3) the 1st to 12th pixels composing the third row of the rectangular pattern are numbered **49, 21, 1, 40, 72, 88, 86, 70, 38, 3, 23, 51**, respectively;

(4) the 1st to 12th pixels composing the fourth row of the rectangular pattern are numbered **17, 9, 36, 60, 84, 96, 94, 82, 58, 34, 11, and 19**, respectively;

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(5) the 1st to 12th pixels composing the fifth row of the rectangular pattern are numbered **45, 13, 32, 56, 80, 92, 90, 78, 54, 30, 15, and 47**, respectively;

(6) the 1st to 12th pixels composing the sixth row of the rectangular pattern are numbered **61, 41, 5, 28, 68, 76, 74, 66, 26, 7, 43, and 63**, respectively;

(7) the 1st to 12th pixels composing the seventh row of the rectangular pattern are numbered **85, 69, 37, 4, 24, 52, 50, 22, 2, 39, 71, and 87**, respectively; and

(8) the 1st to 12th pixels composing the eighth row of the rectangular pattern are numbered **93, 81, 57, 33, 12, 20, 18, 10, 35, 59, 83, and 95**, respectively.

In other words, the sequence of turning on the 96 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 12th pixels composing the first row of the rectangular pattern are turned on 8th, 20th, 44th, 68th, 81st, 49th, 51st, 83rd, 66th, 42nd, 18th, and 6th, respectively;

(2) the 1st to 12th pixels composing the second row of the rectangular pattern are turned on 24th, 32nd, 72nd, 89th, 53rd, 33rd, 35th, 55th, 91st, 70th, 30th, and 22nd, respectively;

(3) the 1st to 12th pixels composing the third row of the rectangular pattern are turned on 48th, 76th, 96th, 57th, 25th, 9th, 11th, 27th, 59th, 94th, 74th, and 46th, respectively;

(4) the 1st to 12th pixels composing the fourth row of the rectangular pattern are turned on 80th, 88th, 61st, 37th, 13th, 1st, 3rd, 15th, 39th, 63rd, 86th, and 78th, respectively;

(5) the 1st to 12th pixels composing the fifth row of the rectangular pattern are turned on 52nd, 84th, 65th, 41st, 17th, 5th, 7th, 19th, 43rd, 67th, 82nd, and 50th, respectively;

(6) the 1st to 12th pixels composing the sixth row of the rectangular pattern are turned on 36th, 56th, 92nd, 69th, 29th, 21st, 23rd, 31st, 71st, 90th, 54th, and 34th, respectively;

(7) the 1st to 12th pixels composing the seventh row of the rectangular pattern are turned on 12th, 28th, 60th, 93rd, 73rd, 45th, 47th, 75th, 95th, 58th, 26th, and 10th, respectively; and

(8) the 1st to 12th pixels composing the eighth row of the rectangular pattern are turned on 4th, 16th, 40th, 64th, 85th, 77th, 79th, 87th, 62nd, 38th, 14th, and 2nd, respectively.

Binary-coding pattern **12f** of FIG. 8 is composed of 96 pixels arranged in a matrix of 8 rows×12 columns, and the sequence of turning on the pixels is set in such a way that dots grows keeping a roughly oval shape (the degree of flattening=0.8). In the unit pattern **12ff** of binary-coding pattern **12f**, two pixels (the pixel numbered **96** and that numbered **94**) that adjoin one another and are disposed adjacently to the center of the rectangular pattern, are first turned on successively in this order. In binary-coding pattern **12f** of FIG. 8, the 96 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 12th pixels composing the first row of the rectangular pattern are numbered **89, 73, 41, 9, 24, 56, 54, 22, 11, 43, 75, and 91**, respectively;

(2) the 1st to 12th pixels composing the second row of the rectangular pattern are numbered **81, 61, 25, 8, 40, 72, 70, 38, 6, 27, 63, and 83**, respectively;

(3) the 1st to 12th pixels composing the third row of the rectangular pattern are numbered **57, 33, 1, 32, 68, 88, 86, 66, 30, 3, 35, and 59**, respectively;

(4) the 1st to 12th pixels composing the fourth row of the rectangular pattern are numbered **49, 17, 16, 48, 80, 96, 94, 78, 46, 14, 19, and 51**, respectively;

(5) the 1st to 12th pixels composing the fifth row of the rectangular pattern are numbered **53, 21, 12, 44, 76, 92, 90, 74, 42, 10, 23, and 55**, respectively;

(6) the 1st to 12th pixels composing the sixth row of the rectangular pattern are numbered **69, 37, 5, 28, 64, 84, 82, 62, 26, 7, 39, and 71**, respectively;

(7) the 1st to 12th pixels composing the seventh row of the rectangular pattern are numbered **85, 65, 29, 4, 36, 60, 58, 34, 2, 31, 67, and 87**, respectively; and

(8) the 1st to 12th pixels composing the eighth row of the rectangular pattern are numbered **93, 77, 45, 13, 20, 52, 50, 18, 15, 47, 79, and 95**, respectively.

In other words, the sequence of turning on the 96 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 12th pixels composing the first row of the rectangular pattern are turned on 8th, 24th, 56th, 88th, 73rd, 41st, 43rd, 75th, 86th, 54th, 22nd, and 6th, respectively;

(2) the 1st to 12th pixels composing the second row of the rectangular pattern are turned on 16th, 36th, 72nd, 89th, 57th, 25th, 27th, 59th, 91st, 70th, 34th, and 14th, respectively;

(3) the 1st to 12th pixels composing the third row of the rectangular pattern are turned on 40th, 64th, 96th, 65th, 29th, 9th, 11th, 31st, 67th, 94th, 62nd, and 38th, respectively;

(4) the 1st to 12th pixels composing the fourth row of the rectangular pattern are turned on 48th, 80th, 81st, 49th, 17th, 1st, 3rd, 19th, 51st, 83rd, 78th, and 46th, respectively;

(5) the 1st to 12th pixels composing the fifth row of the rectangular pattern are turned on 44th, 76th, 85th, 53rd, 21st, 5th, 7th, 23rd, 55th, 87th, 74th, and 42nd, respectively;

(6) the 1st to 12th pixels composing the sixth row of the rectangular pattern are turned on 28th, 60th, 92nd, 69th, 33rd, 13th, 15th, 35th, 71st, 90th, 58th, and 26th, respectively;

(7) the 1st to 12th pixels composing the seventh row of the rectangular pattern are turned on 12th, 32nd, 68th, 93rd, 61st, 37th, 39th, 63rd, 95th, 66th, 30th, and 10th, respectively; and

(8) the 1st to 12th pixels composing the eighth row of the rectangular pattern are turned on 4th, 20th, 52nd, 84th, 77th, 45th, 47th, 79th, 82nd, 50th, 18th, and 2nd, respectively.

Binary-coding pattern **12g** of FIG. **9** is composed of 96 pixels arranged in a matrix of 12 rows×8 columns, and the sequence of turning on the pixels is set in such a way that dots having a roughly round shape grow substantially from the midpoint of each side of the rectangular pattern. In unit pattern **12gg** of binary-coding pattern **12g**, which unit pattern **12gg** is formed when binary-coding patterns **12g** are tiled both vertically and horizontally, two pixels (the pixel numbered **96** and that numbered **94**) that adjoin one another and are disposed adjacently to the center of unit pattern **12gg**, are first turned on successively in this order. In binary-coding pattern **12g** of FIG. **9**, the 96 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 8th pixels composing the first row of the rectangular pattern are numbered **16, 56, 84, 92, 90, 76, 44, and 6**, respectively;

(2) the 1st to 8th pixels composing the second row of the rectangular pattern are numbered **34, 54, 68, 74, 82, 66, 24, and 4**, respectively;

(3) the 1st to 8th pixels composing the third row of the rectangular pattern are numbered **11, 32, 22, 42, 52, 50, 30, and 19**, respectively;

(4) the 1st to 8th pixels composing the fourth row of the rectangular pattern are numbered **47, 27, 37, 2, 14, 39, 63, and 61**, respectively;

(5) the 1st to 8th pixels composing the fifth row of the rectangular pattern are numbered **79, 69, 59, 35, 9, 25, 71, and 87**, respectively;

(6) the 1st to 8th pixels composing the sixth row of the rectangular pattern are numbered **93, 85, 57, 17, 7, 45, 77, and 95**, respectively;

(7) the 1st to 8th pixels composing the seventh row of the rectangular pattern are numbered **89, 75, 43, 5, 15, 55, 83, and 91**, respectively;

(8) the 1st to 8th pixels composing the eighth row of the rectangular pattern are numbered **81, 65, 23, 3, 33, 53, 67, and 73**, respectively;

(9) the 1st to 8th pixels composing the ninth row of the rectangular pattern are numbered **51, 49, 29, 20, 12, 31, 21, and 41**, respectively;

(10) the 1st to 8th pixels composing the 10th row of the rectangular pattern are numbered **13, 40, 64, 62, 48, 28, 38, and 1**, respectively;

(11) the 1st to 8th pixels composing the 11th row of the rectangular pattern are numbered **10, 26, 72, 88, 80, 70, 60, and 36**, respectively; and

(12) the 1st to 8th pixels composing the twelfth row of the rectangular pattern are numbered **8, 46, 78, 96, 94, 86, 58, and 18**, respectively.

In other words, the sequence of turning on the 96 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 8th pixels composing the first row of the rectangular pattern are turned on 81st, 41st, 13th, 5th, 7th, 21st, 53rd, and 91st, respectively;

(2) the 1st to 8th pixels composing the second row of the rectangular pattern are turned on 63rd, 43rd, 29th, 23rd, 15th, 31st, 73rd, and 93rd, respectively;

(3) the 1st to 8th pixels composing the third row of the rectangular pattern are turned on 86th, 65th, 75th, 55th, 45th, 47th, 67th, and 78th, respectively;

(4) the 1st to 8th pixels composing the fourth row of the rectangular pattern are turned on 50th, 70th, 60th, 95th, 83rd, 58th, 34th, and 36th, respectively;

(5) the 1st to 8th pixels composing the fifth row of the rectangular pattern are turned on 18th, 28th, 38th, 62nd, 88th, 72nd, 26th, and 10th, respectively;

(6) the 1st to 8th pixels composing the sixth row of the rectangular pattern are turned on 4th, 12th, 40th, 80th, 90th, 52nd, 20th, and 2nd, respectively;

(7) the 1st to 8th pixels composing the seventh row of the rectangular pattern are turned on 8th, 22nd, 54th, 92nd, 82nd, 42nd, 14th, 6th, respectively;

(8) the 1st to 8th pixels composing the eighth row of the rectangular pattern are turned on 16th, 32nd, 74th, 94th, 64th, 44th, 30th, and 24th, respectively;

(9) the 1st to 8th pixels composing the ninth row of the rectangular pattern are turned on 46th, 48th, 68th, 77th, 85th, 66th, 76th, and 56th, respectively;

(10) the 1st to 8th pixels composing the 10th row of the rectangular pattern are turned on 84th, 57th, 33rd, 35th, 49th, 69th, 59th, and 96th, respectively;

(11) the 1st to 8th pixels composing the 11th row of the rectangular pattern are turned on 87th, 71st, 25th, 9th, 17th, 27th, 37th, and 61st, respectively; and

(12) the 1st to 8th pixels composing the twelfth row of the rectangular pattern are turned on 89th, 51st, 19th, 1st, 3rd, 11th, 39th, and 79th, respectively.

Binary-coding pattern **12h** of FIG. **10** is composed of 96 pixels arranged in a matrix of 12 rows×8 columns, and the sequence of turning on the pixels is set in such a way that dots having a roughly oval shape (the degree of flattening≈0.8) grow substantially from the midpoint of each side of the rectangular pattern. In the unit pattern **12hh** of binary-coding pattern **12h**, which unit pattern is formed when binary-form dither matrix patterns **12h** are tiled both vertically and horizontally, two pixels (the pixel numbered **96** and that numbered **94**) that adjoin one another and are disposed adjacently to the center of unit pattern **12hh**, are first turned on successively in this order. In binary-coding pattern **12h** of FIG. **10**, the 96 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 8th pixels composing the first row of the rectangular pattern are numbered **14, 44, 76, 90, 94, 82, 42, and 2**, respectively;

(2) the 1st to 8th pixels composing the second row of the rectangular pattern are numbered **20, 34, 62, 74, 86, 70, 40, and 10**, respectively;

(3) the 1st to 8th pixels composing the third row of the rectangular pattern are numbered **7, 18, 28, 38, 58, 66, 54, and 31**, respectively;

(4) the 1st to 8th pixels composing the fourth row of the rectangular pattern are numbered **51, 29, 23, 6, 26, 55, 67, and 59**, respectively;

(5) the 1st to 8th pixels composing the fifth row of the rectangular pattern are numbered **79, 63, 35, 21, 11, 49, 71, and 87**, respectively;

(6) the 1st to 8th pixels composing the sixth row of the rectangular pattern are numbered **91, 77, 45, 15, 3, 47, 83, and 95**, respectively;

(7) the 1st to 8th pixels composing the seventh row of the rectangular pattern are numbered **93, 81, 41, 1, 13, 43, 75, and 89**, respectively;

(8) the 1st to 8th pixels composing the eighth row of the rectangular pattern are numbered **85, 69, 39, 9, 19, 33, 61, and 73**, respectively;

(9) the 1st to 8th pixels composing the ninth row of the rectangular pattern are numbered **57, 65, 53, 32, 8, 17, 27, and 37**, respectively;

(10) the 1st to 8th pixels composing the tenth row of the rectangular pattern are numbered **25, 56, 68, 60, 52, 30, 24, and 5**, respectively;

(11) the 1st to 8th pixels composing the eleventh row of the rectangular pattern are numbered **12, 50, 72, 88, 80, 64, 36, and 22**, respectively; and

(12) the 1st to 8th pixels composing the twelfth row of the rectangular pattern are numbered **4, 48, 84, 96, 92, 78, 46, and 16**, respectively.

In other words, the sequence of turning on the 96 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 8th pixels composing the first row of the rectangular pattern are turned on 83rd, 53rd, 21st, 7th, 3rd, 15th, 55th, and 95th, respectively;

(2) the 1st to 8th pixels composing the second row of the rectangular pattern are turned on 77th, 63rd, 35th, 23rd, 11th, 27th, 57th, and 87th, respectively;

(3) the 1st to 8th pixels composing the third row of the rectangular pattern are turned on 90th, 79th, 69th, 59th, 39th, 31st, 43rd, and 66th, respectively;

(4) the 1st to 8th pixels composing the fourth row of the rectangular pattern are turned on 46th, 68th, 74th, 91st, 71st, 42nd, 30th, and 38th, respectively;

(5) the 1st to 8th pixels composing the fifth row of the rectangular pattern are turned on 18th, 34th, 62nd, 76th, 86th, 48th, 26th, and 10th, respectively;

(6) the 1st to 8th pixels composing the sixth row of the rectangular pattern are turned on 6th, 20th, 52nd, 82nd, 94th, 50th, 14th, 2nd, respectively;

(7) the 1st to 8th pixels composing the seventh row of the rectangular pattern are turned on 4th, 16th, 56th, 96th, 84th, 54th, 22nd, and 8th, respectively;

(8) the 1st to 8th pixels composing the eighth row of the rectangular pattern are turned on 12th, 28th, 58th, 88th, 78th, 64th, 36th, and 24th, respectively;

(9) the 1st to 8th pixels composing the ninth row of the rectangular pattern are turned on 40th, 32nd, 44th, 65th, 89th, 80th, 70th, and 60th, respectively;

(10) the 1st to 8th pixels composing the tenth row of the rectangular pattern are turned on 72nd, 41st, 29th, 37th, 45th, 67th, 73rd, and 92nd, respectively;

(11) the 1st to 8th pixels composing the eleventh row of the rectangular pattern are turned on 85th, 47th, 25th, 9th, 17th, 33rd, 61st, and 75th, respectively; and

(12) the 1st to 8th pixels composing the twelfth row of the rectangular pattern are turned on 93rd, 49th, 13th, 1st, 5th, 19th, 51st, and 81st, respectively.

Binary-coding pattern **12i** of FIG. **11** is composed of 576 pixels arranged in a matrix of 24 rows×24 columns, and has substantially the same construction as that which is obtained by tiling binary-form dither matrix patterns **12a** of FIG. **2**, (a) and (b), both vertically and horizontally. In binary-coding pattern **12i**, the sequence of turning on the pixels is set in such a way that dots having a roughly round shape grow in every rectangular pattern. In each unit pattern **12ii** of binary-coding pattern **12i**, two pixels (for example, the pixel numbered **576** and that numbered **563**) that adjoin one another and are disposed adjacently to the center of unit pattern **12ii**, are first turned on successively. In binary-coding pattern **12i** of FIG. **11**, the 576 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are numbered **260, 68, 98, 290, 434, 530, 554, 458, 314, 122, 92, 284, 261, 69, 99, 291, 435, 531, 555, 459, 315, 123, 93, and 285**, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are numbered **356, 212, 20, 146, 386, 482, 506, 410, 170, 44, 236, 380, 357, 213, 21, 147, 387, 483, 507, 411, 171, 45, 237, and 381**, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are numbered **500, 404, 164, 2, 194, 338, 362, 218, 26, 188, 428, 524, 501, 405, 165, 3, 195, 339, 363, 219, 27, 189, 429, and 525**, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are numbered **548, 452, 308, 116, 50, 242, 266, 74, 140, 332, 476, 572, 549, 453, 309, 117, 51, 243, 267, 75, 141, 333, 477, and 573**, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are numbered **560, 464, 320, 128, 86, 278, 254, 62, 104, 296, 440, 536, 561, 465, 321, 129, 87, 279, 255, 63, 105, 297, 441, and 537**, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are numbered **512, 416, 176, 38, 230, 374, 350, 206, 14, 152, 392, 488, 513, 417, 177, 39, 231, 375, 351, 207, 15, 153, 393, and 489**, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are numbered **368, 224, 32, 182, 422, 518, 494, 398, 158, 8, 200, 344, 369, 225, 33, 183, 423, 519, 495, 399, 159, 9, 201, and 345**, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are numbered **272, 80, 134, 326, 470, 566, 542, 446, 302, 110, 56, 248, 273, 81, 135, 327, 471, 567, 543, 447, 303, 111, 57, and 249**, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are numbered **264, 72, 102, 294, 438, 534, 558, 462, 318, 126, 96, 288, 263, 71, 101, 293, 437, 533, 557, 461, 317, 125, 95, and 287**, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are numbered **360, 216, 24, 150, 390, 486, 510, 414, 174, 48, 240, 384, 359, 215, 23, 149, 389, 485, 509, 413, 173, 47, 239, and 383**, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are numbered **504, 408, 168, 6, 198, 342, 366, 222, 30, 192, 432, 528, 503, 407, 167, 5, 197, 341, 365, 221, 29, 191, 431, and 527**, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are numbered **552, 456, 312, 120, 54, 246, 270, 78, 144, 336, 480, 576, 551, 455, 311, 119, 53, 245, 269, 77, 143, 335, 479, and 575**, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are numbered **564, 468, 324, 132, 90, 282, 258, 66, 108, 300, 444, 540, 563, 467, 323, 131, 89, 281, 257, 65, 107, 299, 443, and 539**, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are numbered **516, 420, 180, 42, 234, 378, 354, 210, 18, 156, 396, 492, 515, 419, 179, 41, 233, 377, 353, 209, 17, 155, 395, and 491**, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are numbered **372, 228, 36, 186, 426, 522, 498, 402, 162, 12, 204, 348, 371, 227, 35, 185, 425, 521, 497, 401, 161, 11, 203, and 347**, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are numbered **276, 84, 138, 330, 474, 570, 546, 450, 306, 114, 60, 252, 275, 83, 137, 329, 473, 569, 545, 449, 305, 113, 59, and 251**, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are numbered **262, 70, 100, 292, 436, 532, 556, 460, 316, 124, 94, 286, 259, 67, 97, 289, 433, 529, 553, 457, 313, 121, 91, and 283**, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are numbered **358, 214, 22, 148, 388, 484, 508, 412, 172, 46, 238, 382, 355, 211, 19, 145, 385, 481, 505, 409, 169, 43, 235, and 379**, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are numbered **502, 406, 166, 4, 196, 340, 364, 220, 28, 190, 430, 526, 499, 403, 163, 1, 193, 337, 361, 217, 25, 187, 427, and 523**, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are numbered **550, 454, 310, 118, 52, 244, 268, 76, 142, 334, 478, 574, 547, 451, 307, 115, 49, 241, 265, 73, 139, 331, 475, and 571**, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are numbered **562, 466, 322, 130, 88, 280, 256, 64, 106, 298, 442, 538, 559, 463, 319, 127, 85, 277, 253, 61, 103, 295, 439, and 535**, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are numbered **514, 418, 178, 40, 232, 376, 352, 208, 16, 154, 394, 490, 511, 415, 175, 37, 229, 373, 349, 205, 13, 151, 391, and 487**, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are numbered **370, 226, 34, 184, 424, 520, 496, 400, 160, 10, 202, 346, 367, 223, 31, 181, 421, 517, 493, 397, 157, 7, 199, and 343**, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are numbered **274, 82, 136, 328, 472,**

568, 544, 448, 304, 112, 58, 250, 271, 79, 133, 325, 469, 565, 541, 445, 301, 109, 55, and 247, respectively.

In other words, the sequence of turning on the 576 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are turned on 317th, 509th, 479th, 287th, 143rd, 47th, 23rd, 119th, 263rd, 455th, 485th, 293rd, 316th, 508th, 478th, 286th, 142nd, 46th, 22nd, 118th, 262nd, 454th, 484th, and 292nd, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are turned on 221st, 365th, 557th, 431st, 191st, 95th, 71st, 167th, 407th, 533rd, 341st, 197th, 220th, 364th, 556th, 430th, 190th, 94th, 70th, 166th, 406th, 532nd, 340th, and 196th, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are turned on 77th, 173rd, 413th, 575th, 383rd, 239th, 215th, 359th, 551st, 389th, 149th, 53rd, 76th, 172nd, 412th, 574th, 382nd, 238th, 214th, 358th, 550th, 388th, 148th, 52nd, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are turned on 29th, 125th, 269th, 461st, 527th, 335th, 311th, 503rd, 437th, 245th, 101st, 5th, 28th, 124th, 268th, 460th, 526th, 334th, 310th, 502nd, 436th, 244th, 100th, and 4th, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are turned on 17th, 113th, 257th, 449th, 491st, 299th, 323rd, 515th, 473rd, 281st, 137th, 41st, 16th, 112th, 256th, 448th, 490th, 298th, 322nd, 514th, 472nd, 280th, 136th, and 40th, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are turned on 65th, 161st, 401st, 539th, 347th, 203rd, 227th, 371st, 563rd, 425th, 185th, 89th, 64th, 160th, 400th, 538th, 346th, 202nd, 226th, 370th, 562nd, 424th, 184th, and 88th, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are turned on 209th, 353rd, 545th, 395th, 155th, 59th, 83rd, 179th, 419th, 569th, 377th, 233rd, 208th, 352nd, 544th, 394th, 154th, 58th, 82nd, 178th, 418th, 568th, 376th, and 232nd, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are turned on 305th, 497th, 443rd, 251st, 107th, 11th, 35th, 131st, 275th, 467th, 521st, 329th, 304th, 496th, 442nd, 250th, 106th, 10th, 34th, 130th, 274th, 466th, 520th, and 328th, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are turned on 313th, 505th, 475th, 283rd, 139th, 43rd, 19th, 115th, 259th, 451st, 481st, 289th, 314th, 506th, 476th, 284th, 140th, 44th, 20th, 116th, 260th, 452nd, 482nd, and 290th, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are turned on 217th, 361st, 553rd, 427th, 187th, 91st, 67th, 163rd, 403rd, 529th, 337th, 193rd, 218th, 362nd, 554th, 428th, 188th, 92nd, 68th, 164th, 404th, 530th, 338th, and 194th, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are turned on 73rd, 169th, 409th, 571st, 379th, 235th, 211th, 355th, 547th, 385th, 145th, 49th, 74th, 170th, 410th, 572nd, 380th, 236th, 212th, 356th, 548th, 386th, 146th, and 50th, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are turned on 25th, 121st, 265th, 457th, 523rd, 331st, 307th, 499th, 433rd, 241st, 97th, 1st, 26th, 122nd, 266th, 458th, 524th, 332nd, 308th, 500th, 434th, 242nd, 98th, and 2nd, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are turned on 13th, 109th, 253rd, 445th,

487th, 295th, 319th, 511th, 469th, 277th, 133rd, 37th, 14th, 110th, 254th, 446th, 488th, 296th, 320th, 512th, 470th, 278th, 134th, and 38th, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are turned on 61st, 157th, 397th, 535th, 343rd, 199th, 223rd, 367th, 559th, 421st, 181st, 85th, 62nd, 158th, 398th, 536th, 344th, 200th, 224th, 368th, 560th, 422nd, 182nd, and 86th, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are turned on 205th, 349th, 541st, 391st, 151st, 55th, 79th, 175th, 415th, 565th, 373rd, 229th, 206th, 350th, 542nd, 392nd, 152nd, 56th, 80th, 176th, 416th, 566th, 374th, and 230th, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are turned on 301st, 493rd, 439th, 247th, 103rd, 7th, 31st, 127th, 271st, 463rd, 517th, 325th, 302nd, 494th, 440th, 248th, 104th, 8th, 32nd, 128th, 272nd, 464th, 518th, and 326th, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are turned on 315th, 507th, 477th, 285th, 141st, 45th, 21st, 117th, 261st, 453rd, 483rd, 291st, 318th, 510th, 480th, 288th, 144th, 48th, 24th, 120th, 264th, 456th, 486th, and 294th, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are turned on 219th, 363rd, 555th, 429th, 189th, 93rd, 69th, 165th, 405th, 531st, 339th, 195th, 222nd, 366th, 558th, 432nd, 192nd, 96th, 72nd, 168th, 408th, 534th, 342nd, and 198th, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are turned on 75th, 171st, 411th, 573rd, 381st, 237th, 213th, 357th, 549th, 387th, 147th, 51st, 78th, 174th, 414th, 576th, 384th, 240th, 216th, 360th, 552nd, 390th, 150th, and 54th, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are turned on 27th, 123rd, 267th, 459th, 525th, 333rd, 309th, 501st, 435th, 243rd, 99th, 3rd, 30th, 126th, 270th, 462nd, 528th, 336th, 312th, 504th, 438th, 246th, 102nd, and 6th, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are turned on 15th, 111th, 255th, 447th, 489th, 297th, 321st, 513th, 471st, 279th, 135th, 39th, 18th, 114th, 258th, 450th, 492nd, 300th, 324th, 516th, 474th, 282nd, 138th, and 42nd, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are turned on 63rd, 159th, 399th, 537th, 345th, 201st, 225th, 369th, 561st, 423rd, 183rd, 87th, 66th, 162nd, 402nd, 540th, 348th, 204th, 228th, 372nd, 564th, 426th, 186th, and 90th, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are turned on 207th, 351st, 543rd, 393rd, 153rd, 57th, 81st, 177th, 417th, 567th, 375th, 231st, 210th, 354th, 546th, 396th, 156th, 60th, 84th, 180th, 420th, 570th, 378th, and 234th, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are turned on 303rd, 495th, 441st, 249th, 105th, 9th, 33rd, 129th, 273rd, 465th, 519th, 327th, 306th, 498th, 444th, 252nd, 108th, 12th, 36th, 132nd, 276th, 468th, 522nd, and 330th, respectively.

Binary-coding pattern 12j of FIG. 12 is composed of 576 pixels arranged in a matrix of 24 rows×24 columns, and has substantially the same construction as that which is obtained by tiling binary-form dither matrix patterns 12b of FIG. 4 both vertically and horizontally. In binary-coding pattern 12j, the sequence of turning on of the pixels is set in such a way that dots having a roughly oval shape (the degree of flattening≈0.8) grow in respective unit patterns 12ji. In each unit pattern 12jj of binary-coding pattern 12j, two pixels (for

example, the pixel numbered 576 and that numbered 563) that are disposed diametrically symmetrically to one another with respect to the center of the unit pattern are first turned on successively. In binary-coding pattern 12j of FIG. 12, the 576 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are numbered 308, 116, 50, 242, 434, 530, 554, 458, 266, 74, 140, 332, 309, 117, 51, 243, 435, 531, 555, 459, 267, 75, 141, and 333, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are numbered 404, 212, 20, 146, 338, 482, 506, 362, 170, 44, 236, 428, 405, 213, 21, 147, 339, 483, 507, 363, 171, 45, 237, and 429, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are numbered 500, 356, 164, 2, 194, 386, 410, 218, 26, 188, 380, 524, 501, 357, 165, 3, 195, 387, 411, 219, 27, 189, 381, and 525, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are numbered 548, 452, 260, 68, 98, 290, 314, 122, 92, 284, 476, 572, 549, 453, 261, 69, 99, 291, 315, 123, 93, 285, 477, and 573, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are numbered 560, 464, 272, 80, 134, 326, 302, 110, 56, 248, 440, 536, 561, 465, 273, 81, 135, 327, 303, 111, 57, 249, 441, and 537, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are numbered 512, 368, 176, 38, 230, 422, 398, 206, 14, 152, 344, 488, 513, 369, 177, 39, 231, 423, 399, 207, 15, 153, 345, and 489, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are numbered 416, 224, 32, 182, 374, 518, 494, 350, 158, 8, 200, 392, 417, 225, 33, 183, 375, 519, 495, 351, 159, 9, 201, and 393, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are numbered 320, 128, 86, 278, 470, 566, 542, 446, 254, 62, 104, 296, 321, 129, 87, 279, 471, 567, 543, 447, 255, 63, 105, and 297, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are numbered 312, 120, 54, 246, 438, 534, 558, 462, 270, 78, 144, 336, 311, 119, 53, 245, 437, 533, 557, 461, 269, 77, 143, and 335, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are numbered 408, 216, 24, 150, 342, 486, 510, 366, 174, 48, 240, 432, 407, 215, 23, 149, 341, 485, 509, 365, 173, 47, 239, and 431, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are numbered 504, 360, 168, 6, 198, 390, 414, 222, 30, 192, 384, 528, 503, 359, 167, 5, 197, 389, 413, 221, 29, 191, 383, and 527, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are numbered 552, 456, 264, 72, 102, 294, 318, 126, 96, 288, 480, 576, 551, 455, 263, 71, 101, 293, 317, 125, 95, 287, 479, and 575, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are numbered 564, 468, 276, 84, 138, 330, 306, 114, 60, 252, 444, 540, 563, 467, 275, 83, 137, 329, 305, 113, 59, 251, 443, and 539, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are numbered 516, 372, 180, 42, 234, 426, 402, 210, 18, 156, 348, 492, 515, 371, 179, 41, 233, 425, 401, 209, 17, 155, 347, and 491, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are numbered 420, 228, 36, 186, 378, 522, 498, 354, 162, 12, 204, 396, 419, 227, 35, 185, 377, 521, 497, 353, 161, 11, 203, and 395, respectively;

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(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are numbered **324, 132, 90, 282, 474, 570, 546, 450, 258, 66, 108, 300, 323, 131, 89, 281, 473, 569, 545, 449, 257, 65, 107, and 299**, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are numbered **310, 118, 52, 244, 436, 532, 556, 460, 268, 76, 142, 334, 307, 115, 49, 241, 433, 529, 553, 457, 265, 73, 139, and 331**, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are numbered **406, 214, 22, 148, 340, 484, 508, 364, 172, 46, 238, 430, 403, 211, 19, 145, 337, 481, 505, 361, 169, 43, 235, and 247**, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are numbered **502, 358, 166, 4, 196, 388, 412, 220, 28, 190, 382, 526, 499, 355, 163, 1, 193, 385, 409, 217, 25, 187, 379, and 523**, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are numbered **550, 454, 262, 70, 100, 292, 316, 124, 94, 286, 478, 574, 547, 451, 259, 67, 97, 289, 313, 121, 91, 283, 475, and 571**, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are numbered **562, 466, 274, 82, 136, 328, 304, 112, 58, 250, 442, 538, 559, 463, 271, 79, 133, 325, 301, 109, 55, 247, 439, and 535**, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are numbered **514, 370, 178, 40, 232, 424, 400, 208, 16, 154, 346, 490, 511, 367, 175, 37, 229, 421, 397, 205, 13, 151, 343, and 487**, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are numbered **418, 226, 34, 184, 376, 520, 496, 352, 160, 10, 202, 394, 415, 223, 31, 181, 373, 517, 493, 349, 157, 7, 199, and 391**, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are numbered **322, 130, 88, 280, 472, 568, 544, 448, 256, 64, 106, 298, 319, 127, 85, 277, 469, 565, 541, 445, 253, 61, 103, and 295**, respectively.

In other words, the sequence of turning on the 576 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are turned on 269th, 461st, 527th, 335th, 143rd, 47th, 23rd, 119th, 311th, 503rd, 437th, 245th, 268th, 460th, 526th, 334th, 142nd, 46th, 22nd, 118th, 310th, 502nd, 436th, and 244th, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are turned on 173rd, 365th, 557th, 431st, 239th, 95th, 71st, 215th, 407th, 533rd, 341st, 149th, 172nd, 364th, 556th, 430th, 238th, 94th, 70th, 214th, 406th, 532nd, 340th, and 148th, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are turned on 77th, 221st, 413th, 575th, 383rd, 191st, 167th, 359th, 551st, 389th, 197th, 53rd, 76th, 220th, 412th, 574th, 382nd, 190th, 166th, 358th, 550th, 388th, 196th, and 52nd, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are turned on 29th, 125th, 317th, 509th, 479th, 287th, 263rd, 455th, 485th, 293rd, 101st, 5th, 28th, 124th, 316th, 508th, 478th, 286th, 262nd, 454th, 484th, 292nd, 100th, and 4th, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are turned on 17th, 113th, 305th, 497th, 443rd, 251st, 275th, 467th, 521st, 329th, 137th, 41st, 16th, 112th, 304th, 496th, 442nd, 250th, 274th, 466th, 520th, 328th, 136th, and 40th, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are turned on 65th, 209th, 401st, 539th, 347th, 155th, 179th, 371st, 563rd, 425th, 233rd, 89th, 64th,

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208th, 400th, 538th, 346th, 154th, 178th, 370th, 562nd, 424th, 232nd, and 88th, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are turned on 161st, 353rd, 545th, 395th, 203rd, 59th, 83rd, 227th, 419h, 569th, 377th, 185th, 160th, 352nd, 544th, 394th, 202nd, 58th, 82nd, 226th, 418th, 568th, 376th, and 184th, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are turned on 257th, 449th, 491st, 299th, 107th, 11th, 35th, 131st, 323rd, 515th, 473rd, 281st, 256th, 448th, 490th, 298th, 106th, 10th, 34th, 130th, 322nd, 514th, 472nd, and 280th, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are turned on 265th, 457th, 523rd, 331st, 139th, 43rd, 19th, 115th, 307th, 499th, 433rd, 241st, 266th, 458th, 524th, 332nd, 140th, 44th, 20th, 116th, 308th, 500th, 434th, and 242nd, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are turned on 169th, 361st, 553rd, 427th, 235th, 91st, 67th, 211th, 403rd, 529th, 337th, 145th, 170th, 362nd, 554th, 428th, 236th, 92nd, 68th, 212th, 404th, 530th, 338th, and 146th, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are turned on 73rd, 217th, 409th, 571st, 379th, 187th, 163rd, 355th, 547th, 385th, 193rd, 49th, 74th, 218th, 410th, 572nd, 380th, 188th, 164th, 356th, 548th, 386th, 194th, and 50th, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are turned on 25th, 121st, 313th, 505th, 475th, 283rd, 259th, 451st, 481st, 289th, 97th, 1st, 26th, 122nd, 314th, 506th, 476th, 284th, 260th, 452nd, 482nd, 290th, 98th, and 2nd, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are turned on 13th, 109th, 301st, 493rd, 439th, 247th, 271st, 463rd, 517th, 325th, 133rd, 37th, 14th, 110th, 302nd, 494th, 440th, 248th, 272nd, 464th, 518th, 326th, 134th, and 38th, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are turned on 61st, 205th, 397th, 535th, 343rd, 151st, 175th, 367th, 559th, 421st, 229th, 85th, 62nd, 206th, 398th, 536th, 344th, 152nd, 176th, 368th, 560th, 422nd, 230th, and 86th, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are turned on 157th, 349th, 541st, 391st, 199th, 55th, 79th, 223rd, 415th, 565th, 373rd, 181st, 158th, 350th, 542nd, 392nd, 200th, 56th, 80th, 224th, 416th, 566th, 374th, and 182nd, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are turned on 253rd, 445th, 487th, 295th, 103rd, 7th, 31st, 127th, 319th, 511th, 469th, 277th, 254th, 446th, 488th, 296th, 104th, 8th, 32nd, 128th, 320th, 512th, 470th, and 278th, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are turned on 267th, 459th, 525th, 333rd, 141st, 45th, 21st, 117th, 309th, 501st, 435th, 243rd, 270th, 462nd, 528th, 336th, 144th, 48th, 24th, 120th, 312th, 504th, 438th, and 246th, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are turned on 171st, 363rd, 555th, 429th, 237th, 93rd, 69th, 213th, 405th, 531st, 339th, 147th, 174th, 366th, 558th, 432nd, 240th, 96th, 72nd, 216th, 408th, 534th, 342nd, and 150th, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are turned on 75th, 219th, 411th, 573rd, 381st, 189th, 165th, 357th, 549th, 387th, 195th, 51st, 78th, 222nd, 414th, 576th, 384th, 192nd, 168th, 360th, 552nd, 390th, 198th, and 54th, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are turned on 27th, 123rd, 315th, 507th, 477th, 285th, 261st, 453rd, 483rd, 291st, 99th, 3rd, 30th, 126th, 318th, 510th, 480th, 288th, 264th, 456th, 486th, 294th, 102nd, and 6th, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are turned on 15th, 111th, 303rd, 495th, 441st, 249th, 273rd, 465th, 519th, 327th, 135th, 39th, 18th, 114th, 306th, 498th, 444th, 252nd, 276th, 468th, 522nd, 330th, 138th, and 42nd, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are turned on 63rd, 207th, 399th, 537th, 345th, 153rd, 177th, 369th, 561st, 423rd, 231st, 87th, 66th, 210th, 402nd, 540th, 348th, 156th, 180th, 372nd, 564th, 426th, 234th, and 90th, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are turned on 159th, 351st, 543rd, 393rd, 201st, 57th, 81st, 225th, 417th, 567th, 375th, 183rd, 162nd, 354th, 546th, 396th, 204th, 60th, 84th, 228th, 420th, 570th, 378th, and 186th, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are turned on 255th, 447th, 489th, 297th, 105th, 9th, 33rd, 129th, 321st, 513th, 471st, 279th, 258th, 450th, 492nd, 300th, 108th, 12th, 36th, 132nd, 324th, 516th, 474th, and 282nd, respectively.

Binary-coding pattern **12k** of FIG. 13 is composed of 576 pixels arranged in a matrix of 24 rows×24 columns, and has substantially the same construction as that which is obtained by tiling binary-form dither matrix patterns **12c** of FIG. 5 both vertically and horizontally. In binary-coding pattern **12k**, the sequence of turning on the pixels is set in such a way that dots having a roughly round shape grow in every rectangular pattern. In each unit pattern **12kk** of binary-coding pattern **12k**, two pixels (for example, the pixel numbered **576** and that numbered **563**) that are disposed diametrically symmetrically to one another with respect to the center of unit pattern **12kk** are first turned on successively. In binary-coding pattern **12k** of FIG. 13, the 576 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are numbered **82, 298, 490, 538, 562, 442, 250, 10, 84, 300, 492, 540, 564, 444, 252, 12, 80, 296, 488, 536, 560, 440, 248,** and **8,** respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are numbered **178, 322, 394, 466, 514, 418, 130, 34, 180, 324, 396, 468, 516, 420, 132, 36, 176, 320, 392, 464, 512, 416, 128,** and **32,** respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are numbered **64, 202, 154, 274, 346, 370, 226, 112, 66, 204, 156, 276, 348, 372, 228, 114, 62, 200, 152, 272, 344, 368, 224,** and **110,** respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are numbered **280, 160, 208, 58, 106, 232, 376, 352, 282, 162, 210, 60, 108, 234, 378, 354, 278, 158, 206, 56, 104, 230, 374,** and **350,** respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are numbered **472, 400, 328, 184, 40, 136, 424, 520, 474, 402, 330, 186, 42, 138, 426, 522, 470, 398, 326, 182, 38, 134, 422,** and **518,** respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are numbered **544, 496, 304, 88, 16, 256, 448, 568, 546, 498, 306, 90, 18, 258, 450, 570, 542, 494, 302, 86, 14, 254, 446,** and **566,** respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are numbered **556, 436, 244, 4, 76, 292,**

484, 532, 558, 438, 246, 6, 78, 294, 486, 534, 554, 434, 242, 2, 74, 290, 482, and **530th,** respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are numbered **508, 412, 124, 28, 172, 316, 388, 460, 510, 414, 126, 30, 174, 318, 390, 462, 506, 410, 122, 26, 170, 314, 386,** and **458,** respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are numbered **340, 364, 220, 118, 70, 196, 148, 268, 342, 366, 222, 120, 72, 198, 150, 270, 338, 362, 218, 116, 68, 194, 146,** and **266,** respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are numbered **100, 238, 382, 358, 286, 166, 214, 52, 102, 240, 384, 360, 288, 168, 216, 54, 98, 236, 380, 356, 284, 164, 212,** and **50,** respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are numbered **46, 142, 430, 526, 478, 406, 334, 190, 48, 144, 432, 528, 480, 408, 336, 192, 44, 140, 428, 524, 476, 404, 332,** and **188,** respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are numbered **22, 262, 454, 574, 550, 502, 310, 94, 24, 264, 456, 576, 552, 504, 312, 96, 20, 260, 452, 572, 548, 500, 308,** and **92,** respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are numbered **79, 295, 487, 535, 559, 439, 247, 7, 83, 299, 491, 539, 563, 443, 251, 11, 81, 297, 489, 537, 561, 441, 249,** and **9,** respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are numbered **175, 319, 391, 463, 511, 415, 127, 31, 179, 323, 395, 467, 515, 419, 131, 35, 177, 321, 393, 465, 513, 417, 129,** and **33,** respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are numbered **61, 199, 151, 271, 343, 367, 223, 109, 65, 203, 155, 275, 347, 371, 227, 113, 63, 201, 153, 273, 345, 369, 225,** and **111,** respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are numbered **277, 157, 205, 55, 103, 229, 373, 349, 281, 161, 209, 59, 107, 233, 377, 353, 279, 159, 207, 57, 105, 231, 375,** and **351,** respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are numbered **469, 397, 325, 181, 37, 133, 421, 517, 473, 401, 329, 185, 41, 137, 425, 521, 471, 399, 327, 183, 39, 135, 423,** and **519,** respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are numbered **541, 493, 301, 85, 13, 253, 445, 565, 545, 497, 305, 89, 17, 257, 449, 569, 543, 495, 303, 87, 15, 255, 447,** and **567,** respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are numbered **553, 433, 241, first, 73, 289, 481, 529, 557, 437, 245, 5, 77, 293, 485, 533, 555, 435, 243, 3, 75, 291, 483,** and **531,** respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are numbered **505, 409, 121, 25, 169, 313, 385, 457, 509, 413, 125, 29, 173, 317, 389, 461, 507, 411, 123, 27, 171, 315, 387,** and **459,** respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are numbered **337, 361, 217, 115, 67, 193, 145, 265, 341, 365, 221, 119, 71, 197, 149, 269, 339, 363, 219, 117, 69, 195, 147,** and **267,** respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are numbered **97, 235, 379, 355, 283, 163, 211, 49, 101, 239, 383, 359, 287, 167, 215, 53, 99, 237, 381, 357, 285, 165, 213,** and **51,** respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are numbered **43, 139, 427, 523, 475, 403, 331, 187, 47, 143, 431, 527, 479, 407, 335, 191, 45, 141, 429, 525, 477, 405, 333,** and **189,** respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are numbered **19, 259, 451, 571, 547, 499, 307, 91, 23, 263, 455, 575, 551, 503, 311, 95, 21, 261, 453, 573, 549th, 501, 309,** and **93,** respectively.

In other words, the sequence of turning on the 576 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are turned on 495th, 279th, 87th, 39th, 15th, 135th, 327th, 567th, 493rd, 277th, 85th, 37th, 13th, 133rd, 325th, 565th, 497th, 281st, 89th, 41st, 17th, 137th, 329th, and 569th, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are turned on 399th, 255th, 183rd, 111th, 63rd, 159th, 447th, 543rd, 397th, 253rd, 181st, 109th, 61st, 157th, 445th, 541st, 401st, 257th, 185th, 113th, 65th, 161st, 449th, and 545th, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are turned on 513th, 375th, 423rd, 303rd, 231st, 207th, 351st, 465th, 511th, 373rd, 421st, 301st, 229th, 205th, 349th, 463rd, 515th, 377th, 425th, 305th, 233rd, 209th, 353rd, and 467th, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are turned on 297th, 417th, 369th, 519th, 471st, 345th, 201st, 225th, 295th, 415th, 367th, 517th, 469th, 343rd, 199th, 223rd, 299th, 419th, 371st, 521st, 473rd, 347th, 203rd, and 227th, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are turned on 105th, 177th, 249th, 393rd, 537th, 441st, 153rd, 57th, 103rd, 175th, 247th, 391st, 535th, 439th, 151st, 55th, 107th, 179th, 251st, 395th, 539th, 443rd, 155th, and 59th, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are turned on 33rd, 81st, 273rd, 489th, 561st, 321st, 129th, 9th, 31st, 79th, 271st, 487th, 559th, 319th, 127th, 7th, 35th, 83rd, 275th, 491st, 563rd, 323rd, 131st, and 11th, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are turned on 21st, 141st, 333rd, 573rd, 501st, 285th, 93rd, 45th, 19th, 139th, 331st, 571st, 499th, 283rd, 91st, 43rd, 23rd, 143rd, 335th, 575th, 503rd, 287th, 95th, and 47th, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are turned on 69th, 165th, 453rd, 549th, 405th, 261st, 189th, 117th, 67th, 163rd, 451st, 547th, 403rd, 259th, 187th, 115th, 71st, 167th, 455th, 551st, 407th, 263rd, 191st, and 119th, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are turned on 237th, 213th, 357th, 459th, 507th, 381st, 429th, 309th, 235th, 211th, 355th, 457th, 505th, 379th, 427th, 307th, 239th, 215th, 359th, 461st, 509th, 383rd, 431st, and 311th, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are turned on 477th, 339th, 195th, 219th, 291st, 411th, 363rd, 525th, 475th, 337th, 193rd, 217th, 289th, 409th, 361st, 523rd, 479th, 341st, 197th, 221st, 293rd, 413th, 365th, and 527th, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are turned on 531st, 435th, 147th, 51st, 99th, 171st, 243rd, 387th, 529th, 433rd, 145th, 49th, 97th, 169th, 241st, 385th, 533rd, 437th, 149th, 53rd, 101st, 173rd, 245th, and 389th, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are turned on 555th, 315th, 123rd, 3rd, 27th, 75th, 267th, 483rd, 553rd, 313th, 121st, 1st, 25th, 73rd, 265th, 481st, 557th, 317th, 125th, 5th, 29th, 77th, 269th, and 485th, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are turned on 498th, 282nd, 90th, 42nd, 18th, 138th, 330th, 570th, 494th, 278th, 86th, 38th, 14th, 134th, 326th, 566th, 496th, 280th, 88th, 40th, 16th, 136th, 328th, and 568th, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are turned on 402nd, 258th, 186th, 114th, 66th, 162nd, 450th, 546th, 398th, 254th, 182nd, 110th, 62nd, 158th, 446th, 542nd, 400th, 256th, 184th, 112th, 64th, 160th, 448th, and 544th, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are turned on 516th, 378th, 426th, 306th, 234th, 210th, 354th, 468th, 512th, 374th, 422nd, 302nd, 230th, 206th, 350th, 464th, 514th, 376th, 424th, 304th, 232nd, 208th, 352nd, and 466th, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are turned on 300th, 420th, 372nd, 522nd, 474th, 348th, 204th, 228th, 296th, 416th, 368th, 518th, 470th, 344th, 200th, 224th, 298th, 418th, 370th, 520th, 472nd, 346th, 202nd, and 226th, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are turned on 108th, 180th, 252nd, 396th, 540th, 444th, 156th, 60th, 104th, 176th, 248th, 392nd, 536th, 440th, 152nd, 56th, 106th, 178th, 250th, 394th, 538th, 442nd, 154th, and 58th, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are turned on 36th, 84th, 276th, 492nd, 564th, 324th, 132nd, 12th, 32nd, 80th, 272nd, 488th, 560th, 320th, 128th, 8th, 34th, 82nd, 274th, 490th, 562nd, 322nd, 130th, and 10th, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are turned on 24th, 144th, 336th, 576th, 504th, 288th, 96th, 48th, 20th, 140th, 332nd, 572nd, 500th, 284th, 92nd, 44th, 22nd, 142nd, 334th, 574th, 502nd, 286th, 94th, and 46th, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are turned on 72nd, 168th, 456th, 552nd, 408th, 264th, 192nd, 120th, 68th, 164th, 452nd, 548th, 404th, 260th, 188th, 116th, 70th, 166th, 454th, 550th, 406th, 262nd, 190th, and 118th, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are turned on 240th, 216th, 360th, 462nd, 510th, 384th, 432nd, 312th, 236th, 212th, 356th, 458th, 506th, 380th, 428th, 308th, 238th, 214th, 358th, 460th, 508th, 382nd, 430th, and 310th, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are turned on 480th, 342nd, 198th, 222nd, 294th, 414th, 366th, 528th, 476th, 338th, 194th, 218th, 290th, 410th, 362nd, 524th, 478th, 340th, 196th, 220th, 292nd, 412th, 364th, and 526th, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are turned on 534th, 438th, 150th, 54th, 102nd, 174th, 246th, 390th, 530th, 434th, 146th, 50th, 98th, 170th, 242nd, 386th, 532nd, 436th, 148th, 52nd, 100th, 172nd, 244th, and 388th, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are turned on 558th, 318th, 126th, 6th, 30th, 78th, 270th, 486th, 554th, 314th, 122nd, 2nd, 26th, 74th, 266th, 482nd, 556th, 316th, 124th, 4th, 28th, 76th, 268th, and 484th, respectively.

Binary-coding pattern **121** of FIG. **14** is composed of 576 pixels arranged in a matrix of 24 rows×24 columns, and has substantially the same construction as that which is obtained by tiling binary-form dither matrix patterns **12d** of FIG. **6** both vertically and horizontally. In binary-coding pattern **121**, the sequence of turning on the pixels is set in such a way that dots having a roughly oval shape (the degree of

flattening \approx 0.8) grow in respective unit patterns. In each unit pattern 1211 of binary-coding pattern 121, two pixels (for example, the pixel numbered 576 and that numbered 563) that are disposed diametrically symmetrically to one another with respect to the center of unit pattern 1211 are first turned on successively. In binary-coding pattern 121 of FIG. 14, the 576 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are numbered 82, 226, 442, 538, 562, 490, 250, 10, 84, 228, 444, 540, 564, 492, 252, 12, 80, 224, 440, 536, 560, 488, 248, and 8, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are numbered 106, 202, 370, 466, 514, 418, 274, 58, 108, 204, 372, 468, 516, 420, 276, 60, 104, 200, 368, 464, 512, 416, 272, and 56, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are numbered 40, 130, 154, 298, 346, 394, 322, 184, 42, 132, 156, 300, 348, 396, 324, 186, 38, 128, 152, 296, 344, 392, 320, and 182, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are numbered 304, 160, 136, 34, 178, 328, 400, 352, 306, 162, 138, 36, 180, 330, 402, 354, 302, 158, 134, 32, 176, 326, 398, and 350, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are numbered 472, 376, 208, 112, 64, 280, 424, 520, 474, 378, 210, 114, 66, 282, 426, 522, 470, 374, 206, 110, 62, 278, 422, and 518, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are numbered 544, 448, 232, 88, 16, 256, 496, 568, 546, 450, 234, 90, 18, 258, 498, 570, 542, 446, 230, 86, 14, 254, 494, and 566, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are numbered 556, 484, 244, 4, 76, 220, 436, 532, 558, 486, 246, 6, 78, 222, 438, 534, 554, 482, 242, 2, 74, 218, 434, and 530, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are numbered 508, 412, 268, 52, 100, 196, 364, 460, 510, 414, 270, 54, 102, 198, 366, 462, 506, 410, 266, 50, 98, 194, 362, and 458, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are numbered 340, 388, 316, 190, 46, 124, 148, 292, 342, 390, 318, 192, 48, 126, 150, 294, 338, 386, 314, 188, 44, 122, 146, and 290, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are numbered 172, 334, 406, 358, 310, 166, 142, 28, 174, 336, 408, 360, 312, 168, 144, 30, 170, 332, 404, 356, 308, 164, 140, and 26, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are numbered 70, 286, 430, 526, 478, 382, 214, 118, 72, 288, 432, 528, 480, 384, 216, 68, 284, 428, 524, 476, 380, 212, and 116, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are numbered 22, 262, 502, 574, 550, 454, 238, 94, 24, 264, 504, 576, 552, 456, 240, 96, 20, 260, 500, 572, 548, 452, 236, and 92, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are numbered 79, 223, 439, 535, 559, 487, 247, 7, 83, 227, 443, 539, 563, 491, 251, 11, 81, 225, 441, 537, 561, 489, 249, and 9, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are numbered 103, 199, 367, 463, 511, 415, 271, 55, 107, 203, 371, 467, 515, 419, 275, 59, 105, 201, 369, 465, 513, 417, 273, and 57, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are numbered 37, 127, 151, 295, 343,

391, 319, 181, 41, 131, 155, 299, 347, 395, 323, 185, 39, 129, 153, 297, 345, 393, 321, and 183, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are numbered 301, 157, 133, 31, 175, 325, 397, 349, 305, 161, 137, 35, 179, 329, 401, 353, 303, 159, 135, 33, 177, 327, 399, and 351, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are numbered 469, 373, 205, 109, 61, 277, 421, 517, 473, 377, 209, 113, 65, 281, 425, 521, 471, 375, 207, 111, 63, 279, 423, and 519, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are numbered 541, 445, 229, 85, 13, 253, 493, 565, 545, 449, 233, 89, 17, 257, 497, 569, 543, 447, 231, 87, 15, 255, 495, and 567, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are numbered 553, 481, 241, 1, 73, 217, 433, 529, 557, 485, 245, 5, 77, 221, 437, 533, 555, 483, 243, 3rd, 75, 219, 435, and 531, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are numbered 505, 409, 265, 49, 97, 193, 361, 457, 509, 413, 269, 53, 101, 197, 365, 461, 507, 411, 267, 51, 99, 195, 363, and 459, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are numbered 337, 385, 313, 187, 43, 121, 145, 289, 341, 389, 317, 191, 47, 125, 149, 293, 339, 387, 315, 189, 45, 123, 147, and 291, respectively;

(22) the 1st to 24th pixels composing the 22 row of the rectangular pattern are numbered 169, 331, 403, 355, 307, 163, 139, 25, 173, 335, 407, 359, 311, 167, 143, 29, 171, 333, 405, 357, 309, 165, 141, and 27, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are numbered 67, 283, 427, 523, 475, 379, 211, 115, 71, 287, 431, 527, 479, 383, 215, 119, 69, 285, 429, 525, 477, 381, 213, and 117, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are numbered 19, 259, 499, 571, 547, 451, 235, 91, 23, 263, 503, 575, 551, 455, 239, 95, 21, 261, 501, 573, 549, 453, 237, and 93, respectively.

In other words, the sequence of turning on the 576 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are turned on 495th, 351st, 135th, 39th, 15th, 87th, 327th, 567th, 493rd, 349th, 133rd, 37th, 13th, 85th, 325th, 565th, 497th, 353rd, 137th, 41st, 17th, 89th, 329th, and 569th, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are turned on 471st, 375th, 207th, 111th, 63rd, 159th, 303rd, 519th, 469th, 373rd, 205th, 109th, 61st, 157th, 301st, 517th, 473rd, 377th, 209th, 113th, 65th, 161st, 305th, and 521st, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are turned on 537th, 447th, 423rd, 279th, 231st, 183rd, 255th, 393rd, 535th, 445th, 421st, 277th, 229th, 181st, 253rd, 391st, 539th, 449th, 425th, 281st, 233rd, 185th, 257th, and 395th, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are turned on 273rd, 417th, 441st, 543rd, 399th, 249th, 177th, 225th, 271st, 415th, 439th, 541st, 397th, 247th, 175th, 223rd, 275th, 419th, 443rd, 545th, 401st, 251st, 179th, and 227th, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are turned on 105th, 201st, 369th, 465th, 513th, 297th, 153rd, 57th, 103rd, 199th, 367th, 463rd, 511th, 295th, 151st, 55th, 107th, 203rd, 371st, 467th, 515th, 299th, 155th, and 59th, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are turned on 33rd, 129th, 345th, 489th, 561st, 321st, 81st, 9th, 31st, 127th, 343rd, 487th, 559th, 319th, 79th, 7th, 35th, 131st, 347th, 491st, 563rd, 323rd, 83rd, and 11th, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are turned on 21st, 93rd, 333rd, 573rd, 501st, 357th, 141st, 45th, 19th, 91st, 331st, 571st, 499th, 355th, 139th, 43rd, 23rd, 95th, 335th, 575th, 503rd, 359th, 143rd, and 47th, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are turned on 69th, 165th, 309th, 525th, 477th, 381st, 213th, 117th, 67th, 163rd, 307th, 523rd, 475th, 379th, 211th, 115th, 71st, 167th, 311th, 527th, 479th, 383rd, 215th, and 119th, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are turned on 237th, 189th, 261st, 387th, 531st, 453rd, 429th, 285th, 235th, 187th, 259th, 385th, 529th, 451st, 427th, 283rd, 239th, 191st, 263rd, 389th, 533rd, 455th, 431st, and 287th, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are turned on 405th, 243rd, 171st, 219th, 267th, 411th, 435th, 549th, 403rd, 241st, 169th, 217th, 265th, 409th, 433rd, 547th, 407th, 245th, 173rd, 221st, 269th, 413th, 437th, and 551st, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are turned on 507th, 291st, 147th, 51st, 99th, 195th, 363rd, 459th, 505th, 289th, 145th, 49th, 97th, 193rd, 361st, 457th, 509th, 293rd, 149th, 53rd, 101st, 197th, 365th, and 461st, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are turned on 555th, 315th, 75th, 3rd, 27th, 123rd, 339th, 483rd, 553rd, 313th, 73rd, 1st, 25th, 121st, 337th, 481st, 557th, 317th, 77th, 5th, 29th, 125th, 341st, and 485th, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are turned on 498th, 354th, 138th, 42nd, 18th, 90th, 330th, 570th, 494th, 350th, 134th, 38th, 14th, 86th, 326th, 566th, 496th, 352nd, 136th, 40th, 16th, 88th, 328th, and 568th, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are turned on 474th, 378th, 210th, 114th, 66th, 162nd, 306th, 522nd, 470th, 374th, 206th, 110th, 62nd, 158th, 302nd, 518th, 472nd, 376th, 208th, 112th, 64th, 160th, 304th, and 520th, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are turned on 540th, 450th, 426th, 282nd, 234th, 186th, 258th, 396th, 536th, 446th, 422nd, 278th, 230th, 182nd, 254th, 392nd, 538th, 448th, 424th, 280th, 232nd, 184th, 256th, and 394th, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are turned on 276th, 420th, 444th, 546th, 402nd, 252nd, 180th, 228th, 272nd, 416th, 440th, 542nd, 398th, 248th, 176th, 224th, 274th, 418th, 442nd, 544th, 400th, 250th, 178th, and 226th, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are turned on 108th, 204th, 372nd, 468th, 516th, 300th, 156th, 60th, 104th, 200th, 368th, 464th, 512th, 296th, 152nd, 56th, 106th, 202nd, 370th, 466th, 514th, 298th, 154th, and 58th, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are turned on 36th, 132nd, 348th, 492nd, 564th, 324th, 84th, 12th, 32nd, 128th, 344th, 488th, 560th, 320th, 80th, 8th, 34th, 130th, 346th, 490th, 562nd, 322nd, 82nd, and 10th, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are turned on 24th, 96th, 336th, 576th,

504th, 360th, 144th, 48th, 20th, 92nd, 332nd, 572nd, 500th, 356th, 140th, 44th, 22nd, 94th, 334th, 574th, 502nd, 358th, 142nd, and 46th, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are turned on 72nd, 168th, 312th, 528th, 480th, 384th, 216th, 120th, 68th, 164th, 308th, 524th, 476th, 380th, 212th, 116th, 70th, 166th, 310th, 526th, 478th, 382nd, 214th, and 118th, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are turned on 240th, 192nd, 264th, 390th, 534th, 456th, 432nd, 288th, 236th, 188th, 260th, 386th, 530th, 452nd, 428th, 284th, 238th, 190th, 262nd, 388th, 532nd, 454th, 430th, and 286th, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are turned on 408th, 246th, 174th, 222nd, 270th, 414th, 438th, 552nd, 404th, 242nd, 170th, 218th, 266th, 410th, 434th, 548th, 406th, 244th, 172nd, 220th, 268th, 412th, 436th, and 550th, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are turned on 510th, 294th, 150th, 54th, 102nd, 198th, 366th, 462nd, 506th, 290th, 146th, 50th, 98th, 194th, 362nd, 458th, 508th, 292nd, 148th, 52nd, 100th, 196th, 364th, and 460th, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are turned on 558th, 318th, 78th, 6th, 30th, 126th, 342nd, 486th, 554th, 314th, 74th, 2nd, 26th, 122nd, 338th, 482nd, 556th, 316th, 76th, 4th, 28th, 124th, 340th, and 484th, respectively.

Binary-coding pattern **12m** of FIG. **15** is composed of 576 pixels arranged in a matrix of 24 rows×24 columns, and has substantially the same construction as that which is obtained by tiling binary-form dither matrix patterns **12e** of FIG. **7** both vertically and horizontally. In binary-coding pattern **12m**, the sequence of turning on of the pixels is set in such a way that dots having a roughly round shape grow in every unit pattern **12mm**. In each unit pattern **12mm** of binary-coding pattern **12m**, two pixels (the pixel numbered **576** and that numbered **563**) that adjoin one another and are disposed adjacently to the center of unit pattern **12mm**, are first turned on successively. In binary-coding pattern **12m** of FIG. **15**, the 576 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are numbered **272, 80, 182, 326, 470, 542, 530, 458, 314, 170, 92, 284, 273, 81, 183, 327, 471, 543, 531, 459, 315, 171, 93, and 285**, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are numbered **368, 248, 32, 158, 398, 446, 434, 386, 146, 44, 260, 380, 369, 249, 33, 159, 399, 447, 435, 387, 147, 45, 261, and 381**, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are numbered **512, 416, 224, 14, 134, 302, 290, 122, 2, 236, 428, 524, 513, 417, 225, 15, 135, 303, 291, 123, 3, 237, 429, and 525**, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are numbered **560, 488, 344, 200, 62, 110, 98, 50, 212, 356, 500, 572, 561, 489, 345, 201, 63, 111, 99, 51, 213, 357, 501, and 573**, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are numbered **536, 464, 320, 176, 86, 278, 266, 74, 188, 332, 476, 548, 537, 465, 321, 177, 87, 279, 267, 75, 189, 333, 477, and 549**, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are numbered **440, 392, 152, 38, 254, 374, 362, 242, 26, 164, 404, 452, 441, 393, 153, 39, 255, 375, 363, 243, 27, 165, 405, and 453**, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are numbered **296, 128, 8, 230, 422, 518, 506, 410, 218, 20, 140, 308, 297, 129, 9, 231, 423, 519, 507, 411, 219, 21, 141, and 309**, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are numbered **104, 56, 206, 350, 494, 566, 554, 482, 338, 194, 68, 116, 105, 57, 207, 351, 495, 567, 555, 483, 339, 195, 69, and 117**, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are numbered **276, 84, 186, 330, 474, 546, 534, 462, 318, 174, 96, 288, 275, 83, 185, 329, 473, 545, 533, 461, 317, 173, 95, and 287**, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are numbered **372, 252, 36, 162, 402, 450, 438, 390, 150, 48, 264, 384, 371, 251, 35, 161, 401, 449, 437, 389, 149, 47, 263, and 383**, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are numbered **516, 420, 228, 18, 138, 306, 294, 126, 6, 240, 432, 528, 515, 419, 227, 17, 137, 305, 293, 125, 5, 239, 431, and 527**, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are numbered **564, 492, 348, 204, 66, 114, 102, 54, 216, 360, 504, 576, 563, 491, 347, 203, 65, 113, 101, 53, 215, 359, 503, and 575**, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are numbered **540, 468, 324, 180, 90, 282, 270, 78, 192, 336, 480, 552, 539, 467, 323, 179, 89, 281, 269, 77, 191, 335, 479, and 551**, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are numbered **444, 396, 156, 42, 258, 378, 366, 246, 30, 168, 408, 456, 443, 395, 155, 41, 257, 377, 365, 245, 29, 167, 407, and 455**, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are numbered **300, 132, 12, 234, 426, 522, 510, 414, 222, 24, 144, 312, 299, 131, 11, 233, 425, 521, 509, 413, 221, 23, 143, and 311**, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are numbered **108, 60, 210, 354, 498, 570, 558, 486, 342, 198, 72, 120, 107, 59, 209, 353, 497, 569, 557, 485, 341, 197, 71, and 119**, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are numbered **274, 82, 184, 328, 472, 544, 532, 460, 316, 172, 94, 286, 271, 79, 181, 325, 469, 541, 529, 457, 313, 169, 91, and 283**, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are numbered **370, 250, 34, 160, 400, 448, 436, 388, 148, 46, 262, 382, 367, 247, 31, 157, 397, 445, 433, 385, 145, 43, 259, and 379**, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are numbered **514, 418, 226, 16, 136, 304, 292, 124, 4, 238, 430, 526, 511, 415, 223, 13, 133, 301, 289, 121, 1, 235, 427, and 523**, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are numbered **562, 490, 346, 202, 64, 112, 100, 52, 214, 358, 502, 574, 559, 487, 343, 199, 61, 109, 97, 49, 211, 355, 499, and 571**, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are numbered **538, 466, 322, 178, 88, 280, 268, 76, 190, 334, 478, 550, 535, 463, 319, 175, 85, 277, 265, 73, 187, 331, 475, and 547**, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are numbered **442, 394, 154, 40, 256, 376, 364, 244, 28, 166, 406, 454, 439, 391, 151, 37, 253, 373, 361, 241, 25, 163, 403, and 451**, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are numbered **298, 130, 10, 232, 424,**

520, 508, 412, 220, 22, 142, 310, 295, 127, 7, 229, 421, 517, 505, 409, 217, 19, 139, and 307, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are numbered **106, 58, 208, 352, 496, 568, 556, 484, 340, 196, 70, 118, 103, 55, 205, 349, 493, 565, 553, 481, 337, 193, 67, and 115**, respectively.

In other words, the sequence of turning on the 576 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are turned on 305th, 497th, 395th, 251st, 107th, 35th, 47th, 119th, 263rd, 407th, 485th, 293rd, 304th, 496th, 394th, 250th, 106th, 34th, 46th, 118th, 262nd, 406th, 484th, and 292nd, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are turned on 209th, 329th, 545th, 419th, 179th, 131st, 143rd, 191st, 431st, 533rd, 317th, 197th, 208th, 328th, 544th, 418th, 178th, 130th, 142nd, 190th, 430th, 532nd, 316th, and 196th, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are turned on 65th, 161st, 353rd, 563rd, 443rd, 275th, 287th, 455th, 575th, 341st, 149th, 53rd, 64th, 160th, 352nd, 562nd, 442nd, 274th, 286th, 454th, 574th, 340th, 148th, and 52nd, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are turned on 17th, 89th, 233rd, 377th, 515th, 467th, 479th, 527th, 365th, 221st, 77th, 5th, 16th, 88th, 232nd, 376th, 514th, 466th, 478th, 526th, 364th, 220th, 76th, and 4th, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are turned on 41st, 113th, 257th, 401st, 491st, 299th, 311th, 503rd, 389th, 245th, 101st, 29th, 40th, 112th, 256th, 400th, 490th, 298th, 310th, 502nd, 388th, 244th, 100th, and 28th, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are turned on 137th, 185th, 425th, 539th, 323rd, 203rd, 215th, 335th, 551st, 413th, 173rd, 125th, 136th, 184th, 424th, 538th, 322nd, 202nd, 214th, 334th, 550th, 412th, 172nd, and 124th, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are turned on 281st, 449th, 569th, 347th, 155th, 59th, 71st, 167th, 359th, 557th, 437th, 269th, 280th, 448th, 568th, 346th, 154th, 58th, 70th, 166th, 358th, 556th, 436th, and 268th, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are turned on 473rd, 521st, 371st, 227th, 83rd, 11th, 23rd, 95th, 239th, 383rd, 509th, 461st, 472nd, 520th, 370th, 226th, 82nd, 10th, 22nd, 94th, 238th, 382nd, 508th, and 460th, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are turned on 301st, 493rd, 391st, 247th, 103rd, 31st, 43rd, 115th, 259th, 403rd, 481st, 289th, 302nd, 494th, 392nd, 248th, 104th, 32nd, 44th, 116th, 260th, 404th, 482nd, and 290th, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are turned on 205th, 325th, 541st, 415th, 175th, 127th, 139th, 187th, 427th, 529th, 313th, 193rd, 206th, 326th, 542nd, 416th, 176th, 128th, 140th, 188th, 428th, 530th, 314th, and 194th, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are turned on 61st, 157th, 349th, 559th, 439th, 271st, 283rd, 451st, 571st, 337th, 145th, 49th, 62nd, 158th, 350th, 560th, 440th, 272nd, 284th, 452nd, 572nd, 338th, 146th, and 50th, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are turned on 13th, 85th, 229th, 373rd, 511th, 463rd, 475th, 523rd, 361st, 217th, 73rd, 1st,

14th, 86th, 230th, 374th, 512th, 464th, 476th, 524th, 362nd, 218th, 74th, and 2nd, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are turned on 37th, 109th, 253rd, 397th, 487th, 295th, 307th, 499th, 385th, 241st, 97th, 25th, 38th, 110th, 254th, 398th, 488th, 296th, 308th, 500th, 386th, 242nd, 98th, and 26th, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are turned on 133rd, 181st, 421st, 535th, 319th, 199th, 211th, 331st, 547th, 409th, 169th, 121st, 134th, 182nd, 422nd, 536th, 320th, 200th, 212th, 332nd, 548th, 410th, 170th, and 122nd, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are turned on 277th, 445th, 565th, 343rd, 151st, 55th, 67th, 163rd, 355th, 553rd, 433rd, 265th, 278th, 446th, 566th, 344th, 152nd, 56th, 68th, 164th, 356th, 554th, 434th, and 266th, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are turned on 469th, 517th, 367th, 223rd, 79th, 7th, 19th, 91st, 235th, 379th, 505th, 457th, 470th, 518th, 368th, 224th, 80th, 8th, 20th, 92nd, 236th, 380th, 506th, and 458th, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are turned on 303rd, 495th, 393rd, 249th, 105th, 33rd, 45th, 117th, 261st, 405th, 483rd, 291st, 306th, 498th, 396th, 252nd, 108th, 36th, 48th, 120th, 264th, 408th, 486th, and 294th, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are turned on 207th, 327th, 543rd, 417th, 177th, 129th, 141st, 189th, 429th, 531st, 315th, 195th, 210th, 330th, 546th, 420th, 180th, 132nd, 144th, 192nd, 432nd, 534th, 318th, and 198th, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are turned on 63rd, 159th, 351st, 561st, 441st, 273rd, 285th, 453rd, 573rd, 339th, 147th, 51st, 66th, 162nd, 354th, 564th, 444th, 276th, 288th, 456th, 576th, 342nd, 150th, and 54th, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are turned on 15th, 87th, 231st, 375th, 513th, 465th, 477th, 525th, 363rd, 219th, 75th, 3rd, 18th, 90th, 234th, 378th, 516th, 468th, 480th, 528th, 366th, 222nd, 78th, and 6th, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are turned on 39th, 111th, 255th, 399th, 489th, 297th, 309th, 501st, 387th, 243rd, 99th, 27th, 42nd, 114th, 258th, 402nd, 492nd, 300th, 312th, 504th, 390th, 246th, 102nd, and 30th, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are turned on 135th, 183rd, 423rd, 537th, 321st, 201st, 213th, 333rd, 549th, 411th, 171st, 123rd, 138th, 186th, 426th, 540th, 324th, 204th, 216th, 336th, 552nd, 414th, 174th, and 126th, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are turned on 279th, 447th, 567th, 345th, 153rd, 57th, 69th, 165th, 357th, 555th, 435th, 267th, 282nd, 450th, 570th, 348th, 156th, 60th, 72nd, 168th, 360th, 558th, 438th, and 270th, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are turned on 471st, 519th, 369th, 225th, 81st, 9th, 21st, 93rd, 237th, 381st, 507th, 459th, 474th, 522nd, 372nd, 228th, 84th, 12th, 24th, 96th, 240th, 384th, 510th, and 462nd, respectively.

Binary-coding pattern $12n$ of FIG. 16 is composed of 576 pixels arranged in a matrix of 24 rows \times 24 columns, and has substantially the same construction as that which is obtained by tiling binary-form dither matrix patterns $12f$ of FIG. 8 both vertically and horizontally. In binary-coding pattern

$12f$, the sequence of turning on the pixels is set in such a way that dots having a roughly oval shape (the degree of flattening=0.8) grow in respective unit patterns $12nn$. In each unit pattern $12nm$ of binary-coding pattern $12n$, two pixels (for example, the pixel numbered 576 and that numbered 563) that are disposed diametrically symmetrically to one another with respect to the center of unit pattern $12nm$ are first turned on successively. In binary-coding pattern $12n$ of FIG. 16, the 576 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are numbered 320, 128, 62, 254, 446, 542, 530, 434, 242, 50, 140, 332, 321, 129, 63, 255, 447, 543, 531, 435, 243, 51, 141, and 333, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are numbered 416, 224, 32, 158, 374, 494, 482, 362, 146, 44, 236, 428, 417, 225, 33, 159, 375, 495, 483, 363, 147, 45, 237, and 429, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are numbered 512, 392, 176, 14, 206, 350, 338, 194, 2, 188, 404, 524, 513, 393, 177, 15, 207, 351, 339, 195, 3, 189, 405, and 525, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are numbered 560, 464, 272, 80, 110, 302, 290, 98, 92, 284, 476, 572, 561, 465, 273, 81, 111, 303, 291, 99, 93, 285, 477, and 573, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are numbered 536, 440, 248, 56, 134, 326, 314, 122, 68, 260, 452, 548, 537, 441, 249, 57, 135, 327, 315, 123, 69, 261, 453, and 549, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are numbered 488, 368, 152, 38, 230, 422, 410, 218, 26, 164, 380, 500, 489, 369, 153, 39, 231, 423, 411, 219, 27, 165, 381, and 501, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are numbered 344, 200, 8, 182, 398, 518, 506, 386, 170, 20, 212, 356, 345, 201, 9, 183, 399, 519, 507, 387, 171, 21, 213, and 357, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are numbered 296, 104, 86, 278, 470, 566, 554, 458, 266, 74, 116, 308, 297, 105, 87, 279, 471, 567, 555, 459, 267, 75, 117, and 309, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are numbered 324, 132, 66, 258, 450, 546, 534, 438, 246, 54, 144, 336, 323, 131, 65, 257, 449, 545, 533, 437, 245, 53, 143, and 335, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are numbered 420, 228, 36, 162, 378, 498, 486, 366, 150, 48, 240, 432, 419, 227, 35, 161, 377, 497, 485, 365, 149, 47, 239, and 431, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are numbered 516, 396, 180, 18, 210, 354, 342, 198, 6, 192, 408, 528, 515, 395, 179, 17, 209, 353, 341, 197, 5, 191, 407, and 527, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are numbered 564, 468, 276, 84, 114, 306, 294, 102, 96, 288, 480, 576, 563, 467, 275, 83, 113, 305, 293, 101, 95, 287, 479, and 575, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are numbered 540, 444, 252, 60, 138, 330, 318, 126, 72, 264, 456, 552, 539, 443, 251, 59, 137, 329, 317, 125, 71, 263, 455, and 551, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are numbered 492, 372, 156, 42, 234, 426, 414, 222, 30, 168, 384, 504, 491, 371, 155, 41, 233, 425, 413, 221, 29, 167, 383, and 503, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are numbered **348, 204, 12, 186, 402, 522, 510, 390, 174, 24, 216, 360, 347, 203, 11, 185, 401, 521, 509, 389, 173, 23, 215, and 359**, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are numbered **300, 108, 90, 282, 474, 570, 558, 462, 270, 78, 120, 312, 299, 107, 89, 281, 473, 569, 557, 461, 269, 77, 119, and 311**, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are numbered **322, 130, 64, 256, 448, 544, 532, 436, 244, 52, 142, 334, 319, 127, 61, 253, 445, 541, 529, 433, 241, 49, 139, and 331**, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are numbered **418, 226, 34, 160, 376, 496, 484, 364, 148, 46, 238, 430, 415, 223, 31, 157, 373, 493, 481, 361, 145, 43, 235, and 427**, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are numbered **514, 394, 178, 16, 208, 352, 340, 196, 4, 190, 406, 526, 511, 391, 175, 13, 205, 349, 337, 193, 1, 187, 403, and 523**, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are numbered **562, 466, 274, 82, 112, 304, 292, 100, 94, 286, 478, 574, 559, 463, 271, 79, 109, 301, 289, 97, 91, 283, 475, and 571**, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are numbered **538, 442, 250, 58, 136, 328, 316, 124, 70, 262, 454, 550, 535, 439, 247, 55, 133, 325, 313, 121, 67, 259, 451, and 547**, respectively;

(22) the 1st to 24th pixels composing the 22 row of the rectangular pattern are numbered **490, 370, 154, 40, 232, 424, 412, 220, 28, 166, 382, 502, 487, 367, 151, 37, 229, 421, 409, 217, 25, 163, 379, and 499**, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are numbered **346, 202, 10, 184, 400, 520, 508, 388, 172, 22, 214, 358, 343, 199, 7, 181, 397, 517, 505, 385, 169, 19, 211, and 355**, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are numbered **298, 106, 88, 280, 472, 568, 556, 460, 268, 76, 118, 310, 295, 103, 85, 277, 469, 565, 553, 457, 265, 73, 115, and 307**, respectively.

In other words, the sequence of turning on the 576 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are turned on **257th, 449th, 515th, 323rd, 131st, 35th, 47th, 143rd, 335th, 527th, 437th, 245th, 256th, 448th, 514th, 322nd, 130th, 34th, 46th, 142nd, 334th, 526th, 436th, and 244th**, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are turned on **161st, 353rd, 545th, 419th, 203rd, 83rd, 95th, 215th, 431st, 533rd, 341st, 149th, 160th, 352nd, 544th, 418th, 202nd, 82nd, 94th, 214th, 430th, 532nd, 340th, and 148th**, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are turned on **65th, 185th, 401st, 563rd, 371st, 227th, 239th, 383rd, 575th, 389th, 173rd, 53rd, 64th, 184th, 400th, 562nd, 370th, 226th, 238th, 382nd, 574th, 388th, 172nd, and 52nd**, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are turned on **17th, 113th, 305th, 497th, 467th, 275th, 287th, 479th, 485th, 293rd, 101st, 5th, 16th, 112th, 304th, 496th, 466th, 274th, 286th, 478th, 484th, 292nd, 100th, and 4th**, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are turned on **41st, 137th, 329th, 521st, 443rd, 251st, 263rd, 455th, 509th, 317th, 125th, 29th, 40th,**

136th, 328th, 520th, 442nd, 250th, 262nd, 454th, 508th, 316th, 124th, and 28th, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are turned on **89th, 209th, 425th, 539th, 347th, 155th, 167th, 359th, 551st, 413th, 197th, 77th, 88th, 208th, 424th, 538th, 346th, 154th, 166th, 358th, 550th, 412th, 196th, and 76th**, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are turned on **233rd, 377th, 569th, 395th, 179th, 59th, 71st, 191st, 407th, 557th, 365th, 221st, 232nd, 376th, 568th, 394th, 178th, 58th, 70th, 190th, 406th, 556th, 364th, and 220th**, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are turned on **281st, 473rd, 491st, 299th, 107th, 11th, 23rd, 119th, 311th, 503rd, 461st, 269th, 280th, 472nd, 490th, 298th, 106th, 10th, 22nd, 118th, 310th, 502nd, 460th, and 268th**, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are turned on **253rd, 445th, 511th, 319th, 127th, 31st, 43rd, 139th, 331st, 523rd, 433rd, 241st, 254th, 446th, 512th, 320th, 128th, 32nd, 44th, 140th, 332nd, 524th, 434th, and 242nd**, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are turned on **157th, 349th, 541st, 415th, 199th, 79th, 91st, 211th, 427th, 529th, 337th, 145th, 158th, 350th, 542nd, 416th, 200th, 80th, 92nd, 212th, 428th, 530th, 338th, and 146th**, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are turned on **61st, 181st, 397th, 559th, 367th, 223rd, 235th, 379th, 571st, 385th, 169th, 49th, 62nd, 182nd, 398th, 560th, 368th, 224th, 236th, 380th, 572nd, 386th, 170th, and 50th**, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are turned on **13th, 109th, 301st, 493rd, 463rd, 271st, 283rd, 475th, 481st, 289th, 97th, 1st, 14th, 110th, 302nd, 494th, 464th, 272nd, 284th, 476th, 482nd, 290th, 98th, and 2nd**, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are turned on **37th, 133rd, 325th, 517th, 439th, 247th, 259th, 451st, 505th, 313th, 121st, 25th, 38th, 134th, 326th, 518th, 440th, 248th, 260th, 452nd, 506th, 314th, 122nd, and 26th**, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are turned on **85th, 205th, 421st, 535th, 343rd, 151st, 163rd, 355th, 547th, 409th, 193rd, 73rd, 86th, 206th, 422nd, 536th, 344th, 152nd, 164th, 356th, 548th, 410th, 194th, and 74th**, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are turned on **229th, 373rd, 565th, 391st, 175th, 55th, 67th, 187th, 403rd, 553rd, 361st, 217th, 230th, 374th, 566th, 392nd, 176th, 56th, 68th, 188th, 404th, 554th, 362nd, and 218th**, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are turned on **277th, 469th, 487th, 295th, 103rd, 7th, 19th, 115th, 307th, 499th, 457th, 265th, 278th, 470th, 488th, 296th, 104th, 8th, 20th, 116th, 308th, 500th, 458th, and 266th**, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are turned on **255th, 447th, 513th, 321st, 129th, 33rd, 45th, 141st, 333rd, 525th, 435th, 243rd, 258th, 450th, 516th, 324th, 132nd, 36th, 48th, 144th, 336th, 528th, 438th, and 246th**, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are turned on **159th, 351st, 543rd, 417th, 201st, 81st, 93rd, 213th, 429th, 531st, 339th, 147th, 162nd, 354th, 546th, 420th, 204th, 84th, 96th, 216th, 432nd, 534th, 342nd, and 150th**, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are turned on 63rd, 183rd, 399th, 561st, 369th, 225th, 237th, 381st, 573rd, 387th, 171st, 51st, 66th, 186th, 402nd, 564th, 372nd, 228th, 240th, 384th, 576th, 390th, 174th, and 54th, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are turned on 15th, 111th, 303rd, 495th, 465th, 273rd, 285th, 477th, 483rd, 291st, 99th, 3rd, 18th, 114th, 306th, 498th, 468th, 276th, 288th, 480th, 486th, 294th, 102nd, and 6th, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are turned on 39th, 135th, 327th, 519th, 441st, 249th, 261st, 453rd, 507th, 315th, 123rd, 27th, 42nd, 138th, 330th, 522nd, 444th, 252nd, 264th, 456th, 510th, 318th, 126th, and 30th, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are turned on 87th, 207th, 423rd, 537th, 345th, 153rd, 165th, 357th, 549th, 411th, 195th, 75th, 90th, 210th, 426th, 540th, 348th, 156th, 168th, 360th, 552nd, 414th, 198th, and 78th, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are turned on 231st, 375th, 567th, 393rd, 177th, 57th, 69th, 189th, 405th, 555th, 363rd, 219th, 234th, 378th, 570th, 396th, 180th, 60th, 72nd, 192nd, 408th, 558th, 366th, and 222nd, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are turned on 279th, 471st, 489th, 297th, 105th, 9th, 21st, 117th, 309th, 501st, 459th, 267th, 282nd, 474th, 492nd, 300th, 108th, 12th, 24th, 120th, 312th, 504th, 462nd, and 270th, respectively.

Binary-coding pattern 12o of FIG. 17 is composed of 576 pixels arranged in a matrix of 24 rows×24 columns, and has substantially the same construction as that which is obtained by tiling binary-form dither matrix patterns 12g of FIG. 9 both vertically and horizontally. In binary-coding pattern 12o, the sequence of turning on the pixels is set in such a way that dots having a roughly round shape grow in every unit pattern 12oo. In each unit pattern 12oo of binary-coding pattern 12o, two pixels (the pixel numbered 576 and that numbered 564) that adjoin one another and are disposed adjacently to the center of unit pattern 12oo, are first turned on successively. In binary-coding pattern 12o of FIG. 17, the 576 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are numbered 94, 334, 502, 550, 538, 454, 262, 34, 96, 336, 504, 552, 540, 456, 264, 36, 92, 332, 500, 548, 536, 452, 260, and 32, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are numbered 202, 322, 406, 442, 490, 394, 142, 22, 204, 324, 408, 444, 492, 396, 144, 24, 200, 320, 404, 440, 488, 392, 140, and 20, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are numbered 64, 190, 130, 250, 310, 298, 178, 112, 66, 192, 132, 252, 312, 300, 180, 114, 62, 188, 128, 248, 308, 296, 176, and 110, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are numbered 280, 160, 220, 10, 82, 232, 376, 364, 282, 162, 222, 12, 84, 234, 378, 366, 278, 158, 218, 8, 80, 230, 374, and 362, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are numbered 472, 412, 352, 208, 52, 148, 424, 520, 474, 414, 354, 210, 54, 150, 426, 522, 470, 410, 350, 206, 50, 146, 422, and 518, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are numbered 556, 508, 340, 100, 40,

268, 460, 568, 558, 510, 342, 102, 42, 270, 462, 570, 554, 506, 338, 98, 38, 266, 458, and 566, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are numbered 532, 448, 256, 28, 88, 328, 496, 544, 534, 450, 258, 30, 90, 330, 498, 546, 530, 446, 254, 26, 86, 326, 494, and 542, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are numbered 484, 388, 136, 16, 196, 316, 400, 436, 486, 390, 138, 18, 198, 318, 402, 438, 482, 386, 134, 14, 194, 314, 398, and 434, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are numbered 304, 292, 172, 118, 70, 184, 124, 244, 306, 294, 174, 120, 72, 186, 126, 246, 302, 290, 170, 116, 68, 182, 122, and 242, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are numbered 76, 238, 382, 370, 286, 166, 226, 4, 78, 240, 384, 372, 288, 168, 228, 6, 74, 236, 380, 368, 284, 164, 224, and 2, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are numbered 58, 154, 430, 526, 478, 418, 358, 214, 60, 156, 432, 528, 480, 420, 360, 216, 56, 152, 428, 524, 476, 416, 356, and 212, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are numbered 46, 274, 466, 574, 562, 514, 346, 106, 48, 276, 468, 576, 564, 516, 348, 108, 44, 272, 464, 572, 560, 512, 344, and 104, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are numbered 91, 331, 499, 547, 535, 451, 259, 31, 95, 335, 503, 551, 539, 455, 263, 35, 93, 333, 501, 549, 537, 453, 261, and 33, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are numbered 199, 319, 403, 439, 487, 391, 139, 19, 203, 323, 407, 443, 491, 395, 143, 23, 201, 321, 405, 441, 489, 393, 141, and 21, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are numbered 61, 187, 127, 247, 307, 295, 175, 109, 65, 191, 131, 251, 311, 299, 179, 113, 63, 189, 129, 249, 309, 297, 177, and 111, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are numbered 277, 157, 217, 7, 79, 229, 373, 361, 281, 161, 221, 11, 83, 233, 377, 365, 279, 159, 219, 9, 81, 231, 375, and 363, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are numbered 469, 409, 349, 205, 49, 145, 421, 517, 473, 413, 353, 209, 53, 149, 425, 521, 471, 411, 351, 207, 51, 147, 423, and 519, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are numbered 553, 505, 337, 97, 37, 265, 457, 565, 557, 509, 341, 101, 41, 269, 461, 569, 555, 507, 339, 99, 39, 267, 459, and 567, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are numbered 529, 445, 253, 25, 85, 325, 493, 541, 533, 449, 257, 29, 89, 329, 497, 545, 531, 447, 255, 27, 87, 327, 495, and 543, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are numbered 481, 385, 133, 13, 193, 313, 397, 433, 485, 389, 137, 17, 197, 317, 401, 437, 483, 387, 135, 15, 195, 315, 399, and 435, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are numbered 301, 289, 169, 115, 67, 181, 121, 241, 305, 293, 173, 119, 71, 185, 125, 245, 303, 291, 171, 117, 69, 183, 123, and 243, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are numbered 73, 235, 379, 367, 283, 163, 223, 1, 77, 239, 383, 371, 287, 167, 227, 5, 75, 237, 381, 369, 285, 165, 225, and 3, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are numbered **55, 151, 427, 523, 475, 415, 355, 211, 59, 155, 431, 527, 479, 419, 359, 215, 57, 153, 429, 525, 477, 417, 357, and 213**, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are numbered **43, 271, 463, 571, 559, 511, 343, 103, 47, 275, 467, 575, 563, 515, 347, 107, 45, 273, 465, 573, 561, 513, 345, and 105**, respectively.

In other words, the sequence of turning on the 576 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are turned on 483rd, 243rd, 75th, 27th, 39th, 123rd, 315th, 543rd, 481st, 241st, 73rd, 25th, 37th, 121st, 313th, 541st, 485th, 245th, 77th, 29th, 41st, 125th, 17th, and 545th, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are turned on 375th, 255th, 171st, 135th, 87th, 183rd, 435th, 555th, 373rd, 253rd, 169th, 133rd, 85th, 181st, 433rd, 553rd, 377th, 257th, 173rd, 137th, 89th, 185th, 437th, and 557th, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are turned on 513th, 387th, 447th, 327th, 267th, 279th, 399th, 465th, 511th, 385th, 445th, 325th, 265th, 277th, 397th, 463rd, 515th, 389th, 449th, 329th, 269th, 281st, 401st, and 467th, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are turned on 297th, 417th, 357th, 567th, 495th, 345th, 201st, 213th, 295th, 415th, 355th, 565th, 493rd, 343rd, 199th, 211th, 299th, 419th, 359th, 569th, 497th, 347th, 203rd, and 215th, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are turned on 105th, 165th, 225th, 369th, 525th, 429th, 153rd, 57th, 103rd, 163rd, 223rd, 367th, 523rd, 427th, 151st, 55th, 107th, 167th, 227th, 371st, 527th, 431st, 155th, and 59th, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are turned on 21st, 69th, 237th, 477th, 537th, 309th, 117th, 9th, 19th, 67th, 235th, 475th, 535th, 307th, 115th, 7th, 23rd, 71st, 239th, 479th, 539th, 311th, 119th, and 11th, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are turned on 45th, 129th, 321st, 549th, 489th, 249th, 81st, 33rd, 43rd, 127th, 319th, 547th, 487th, 247th, 79th, 31st, 47th, 131st, 323rd, 551st, 491st, 251st, 83rd, and 35th, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are turned on 93rd, 189th, 441st, 561st, 381st, 261st, 177th, 141st, 91st, 187th, 439th, 559th, 379th, 259th, 175th, 139th, 95th, 191st, 443rd, 563rd, 383rd, 263rd, 179th, and 143rd, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are turned on 273rd, 285th, 405th, 459th, 507th, 393rd, 453rd, 333rd, 271st, 283rd, 403rd, 457th, 505th, 391st, 451st, 331st, 275th, 287th, 407th, 461st, 509th, 395th, 455th, and 335th, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are turned on 501st, 339th, 195th, 207th, 291st, 411th, 351st, 573rd, 499th, 337th, 193rd, 205th, 289th, 409th, 349th, 571st, 503rd, 341st, 197th, 209th, 293rd, 413th, 353rd, and 575th, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are turned on 519th, 423rd, 147th, 51st, 99th, 159th, 219th, 363rd, 517th, 421st, 145th, 49th, 97th, 157th, 217th, 361st, 521st, 425th, 149th, 53rd, 101st, 161st, 221st, and 365th, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are turned on 531st, 303rd, 111th, 3rd, 15th, 63rd, 231st, 471st, 529th, 301st, 109th, 1st, 13th, 61st, 229th, 469th, 533rd, 305th, 113th, 5th, 17th, 65th, 233rd, and 473rd, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are turned on 486th, 246th, 78th, 30th, 42nd, 126th, 318th, 546th, 482nd, 242nd, 74th, 26th, 38th, 122nd, 314th, 542nd, 484th, 244th, 76th, 28th, 40th, 124th, 316th, and 544th, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are turned on 378th, 258th, 174th, 138th, 90th, 186th, 438th, 558th, 374th, 254th, 170th, 134th, 86th, 182nd, 434th, 554th, 376th, 256th, 172nd, 136th, 88th, 184th, 436th, and 556th, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are turned on 516th, 390th, 450th, 330th, 270th, 282nd, 402nd, 468th, 512th, 386th, 446th, 326th, 266th, 278th, 398th, 464th, 514th, 388th, 448th, 328th, 268th, 280th, 400th, and 466th, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are turned on 300th, 420th, 360th, 570th, 498th, 348th, 204th, 216th, 296th, 416th, 356th, 566th, 494th, 344th, 200th, 212th, 298th, 418th, 358th, 568th, 496th, 346th, 202nd, and 214th, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are turned on 108th, 168th, 228th, 372nd, 528th, 432nd, 156th, 60th, 104th, 164th, 224th, 368th, 524th, 428th, 152nd, 56th, 106th, 166th, 226th, 370th, 526th, 430th, 154th, and 58th, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are turned on 24th, 72nd, 240th, 480th, 540th, 312th, 120th, 12th, 20th, 68th, 236th, 476th, 536th, 308th, 116th, 8th, 22nd, 70th, 238th, 478th, 538th, 310th, 118th, and 10th, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are turned on 48th, 132nd, 324th, 552nd, 492nd, 252nd, 84th, 36th, 44th, 128th, 320th, 548th, 488th, 248th, 80th, 32nd, 46th, 130th, 322nd, 550th, 490th, 250th, 82nd, and 34th, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are turned on 96th, 192nd, 444th, 564th, 384th, 264th, 180th, 144th, 92nd, 188th, 440th, 560th, 380th, 260th, 176th, 140th, 94th, 190th, 442nd, 562nd, 382nd, 262nd, 178th, and 142nd, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are turned on 276th, 288th, 408th, 462nd, 510th, 396th, 456th, 336th, 272nd, 284th, 404th, 458th, 506th, 392nd, 452nd, 332nd, 274th, 286th, 406th, 460th, 508th, 394th, 454th, and 334th, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are turned on 504th, 342nd, 198th, 210th, 294th, 414th, 354th, 576th, 500th, 338th, 194th, 206th, 290th, 410th, 350th, 572nd, 502nd, 340th, 196th, 208th, 292nd, 412th, 352nd, and 574th, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are turned on 522nd, 426th, 150th, 54th, 102nd, 162nd, 222nd, 366th, 518th, 422nd, 146th, 50th, 98th, 158th, 218th, 362nd, 520th, 424th, 148th, 52nd, 100th, 160th, 220th, and 364th, respectively; and

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are turned on 534th, 306th, 114th, 6th, 18th, 66th, 234th, 474th, 530th, 302nd, 110th, 2nd, 14th, 62nd, 230th, 470th, 532nd, 304th, 112th, 4th, 16th, 64th, 232nd, and 472nd, respectively.

Binary-coding pattern **12p** of FIG. **18** is composed of 576 pixels arranged in a matrix of 24 rows×24 columns, and has

substantially the same construction as that which is obtained by tiling binary-form dither matrix patterns **12h** of FIG. 10 both vertically and horizontally. In binary-form dither matrix pattern **12p**, the sequence of turning on the pixels is set in such a way that dots having a roughly oval shape (the degree of flattening=0.8) grow in respective unit patterns **12pp**. In each unit pattern **12pp** of binary-coding pattern **12p**, two pixels (for example, the pixel numbered **576** and that numbered **564**) that are disposed diametrically symmetrically to one another with respect to the center of unit pattern **12pp** are first turned on successively. In binary-coding pattern **12p** of FIG. 18, the 576 pixels are numbered in the following manner, and the turning on of the pixels is carried out in descending numeric order:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are numbered **82, 262, 454, 538, 562, 490, 250, 10, 84, 264, 456, 540, 564, 492, 252, 12, 80, 260, 452, 536, 560, 488, 248, and 8**, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are numbered **118, 202, 370, 442, 514, 418, 238, 58, 120, 204, 372, 444, 516, 420, 240, 60, 116, 200, 368, 440, 512, 416, 236, and 56**, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are numbered **40, 106, 166, 226, 346, 394, 322, 184, 42, 108, 168, 228, 348, 396, 324, 186, 38, 104, 164, 224, 344, 392, 320, and 182**, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are numbered **304, 172, 136, 34, 154, 328, 400, 352, 306, 174, 138, 36, 156, 330, 402, 354, 302, 170, 134, 32, 152, 326, 398, and 350**, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are numbered **472, 376, 208, 124, 64, 292, 424, 520, 474, 378, 210, 126, 66, 294, 426, 522, 470, 374, 206, 122, 62, 290, 422, and 518**, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are numbered **544, 460, 268, 88, 16, 280, 496, 568, 546, 462, 270, 90, 18, 282, 498, 570, 542, 458, 266, 86, 14, 278, 494, and 566**, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are numbered **556, 484, 244, 4, 76, 256, 448, 532, 558, 486, 246, 6, 78, 258, 450, 534, 554, 482, 242, 2, 74, 254, 446, and 530**, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are numbered **508, 412, 232, 52, 112, 196, 364, 436, 510, 414, 234, 54, 114, 198, 366, 438, 506, 410, 230, 50, 110, 194, 362, and 434**, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are numbered **340, 388, 316, 190, 46, 100, 160, 220, 342, 390, 318, 192, 48, 102, 162, 222, 338, 386, 314, 188, 44, 98, 158, and 218**, respectively;

(10) the 1st to 24th pixels composing the tenth row of the rectangular pattern are numbered **148, 334, 406, 358, 310, 178, 142, 28, 150, 336, 408, 360, 312, 180, 144, 30, 146, 332, 404, 356, 308, 176, 140, and 26**, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are numbered **70, 298, 430, 526, 478, 382, 214, 130, 72, 300, 432, 528, 480, 384, 216, 132, 68, 296, 428, 524, 476, 380, 212, and 128**, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are numbered **22, 286, 502, 574, 550, 466, 274, 94, 24, 288, 504, 576, 552, 468, 276, 96, 20, 284, 500, 572, 548, 464, 272, and 92**, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are numbered **79, 259, 451, 535, 559, 487, 247, 7, 83, 263, 455, 539, 563, 491, 251, 11, 81, 261, 453, 537, 561, 489, 249, and 9**, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are numbered **115, 199, 367, 439, 511, 415, 235, 55, 119, 203, 371, 443, 515, 419, 239, 59, 117, 201, 369, 441, 513, 417, 237, and 57**, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are numbered **37, 103, 163, 223, 343, 391, 319, 181, 41, 107, 167, 227, 347, 395, 323, 185, 39, 105, 165, 225, 345, 393, 321, and 183**, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are numbered **301, 169, 133, 31, 151, 325, 397, 349, 305, 173, 137, 35, 155, 329, 401, 353, 303, 171, 135, 33, 153, 327, 399, and 351**, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are numbered **469, 373, 205, 121, 61, 289, 421, 517, 473, 377, 209, 125, 65, 293, 425, 521, 471, 375, 207, 123, 63, 291, 423, and 519**, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are numbered **541, 457, 265, 85, 13, 277, 493, 565, 545, 461, 269, 89, 17, 281, 497, 569, 543, 459, 267, 87, 15, 279, 495, and 567**, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are numbered **553, 481, 241, 1, 73, 253, 445, 529, 557, 485, 245, 5, 77, 257, 449, 533, 555, 483, 243, 3, 75, 255, 447, and 531**, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are numbered **505, 409, 229, 49, 109, 193, 361, 433, 509, 413, 233, 53, 113, 197, 365, 437, 507, 411, 231, 51, 111, 195, 363, and 435**, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are numbered **337, 385, 313, 187, 43, 97, 157, 217, 341, 389, 317, 191, 47, 101, 161, 221, 339, 387, 315, 189, 45, 99, 159, and 219**, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are numbered **145, 331, 403, 355, 307, 175, 139, 25, 149, 335, 407, 359, 311, 179, 143, 29, 147, 333, 405, 357, 309, 177, 141, and 27**, respectively;

(23) the 1st to 24th pixels composing the 23 row of the rectangular pattern are numbered **67, 295, 427, 523, 475, 379, 211, 127, 71, 299, 431, 527, 479, 383, 215, 131, 69, 297, 429, 525, 477, 381, 213, and 129**, respectively;

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are numbered **19, 283, 499, 571, 547, 463, 271, 91, 23, 287, 503, 575, 551, 467, 275, 95, 21, 285, 501, 573, 549, 465, 273, and 93**, respectively.

In other words, the sequence of turning on the 576 pixels is determined in such a way that the pixels are turned on in the following manner:

(1) the 1st to 24th pixels composing the first row of the rectangular pattern are turned on 495th, 315th, 123rd, 39th, 15th, 87th, 327th, 567th, 493rd, 313th, 121st, 37th, 13th, 85th, 325th, 565th, 497th, 317th, 125th, 41st, 17th, 89th, 329th, and 569th, respectively;

(2) the 1st to 24th pixels composing the second row of the rectangular pattern are turned on 459th, 375th, 207th, 135th, 63rd, 159th, 339th, 519th, 457th, 373rd, 205th, 133rd, 61st, 157th, 337th, 517th, 461st, 377th, 209th, 137th, 65th, 161st, 341st, and 521st, respectively;

(3) the 1st to 24th pixels composing the third row of the rectangular pattern are turned on 537th, 471st, 411th, 351st, 231st, 183rd, 255th, 393rd, 535th, 469th, 409th, 349th, 229th, 181st, 253rd, 391st, 539th, 473rd, 413th, 353rd, 233rd, 185th, 257th, and 395th, respectively;

(4) the 1st to 24th pixels composing the fourth row of the rectangular pattern are turned on 273rd, 405th, 441st, 543rd, 423rd, 249th, 177th, 225th, 271st, 403rd, 439th, 541st, 421st, 247th, 175th, 223rd, 275th, 407th, 443rd, 545th, 425th, 251st, 179th, and 227th, respectively;

(5) the 1st to 24th pixels composing the fifth row of the rectangular pattern are turned on 105th, 201st, 369th, 453rd, 513th, 285th, 153rd, 57th, 103rd, 199th, 367th, 451st, 511th, 283rd, 151st, 55th, 107th, 203rd, 371st, 455th, 515th, 287th, 155th, and 59th, respectively;

(6) the 1st to 24th pixels composing the sixth row of the rectangular pattern are turned on 33rd, 117th, 309th, 489th, 561st, 297th, 81st, 9th, 31st, 115th, 307th, 487th, 559th, 295th, 79th, 7th, 35th, 119th, 311th, 491st, 563rd, 299th, 83rd, and 11th, respectively;

(7) the 1st to 24th pixels composing the seventh row of the rectangular pattern are turned on 21st, 93rd, 333rd, 573rd, 501st, 321st, 129th, 45th, 19th, 91st, 331st, 571st, 499th, 319th, 127th, 43rd, 23rd, 95th, 335th, 575th, 503rd, 323rd, 131st, and 47th, respectively;

(8) the 1st to 24th pixels composing the eighth row of the rectangular pattern are turned on 69th, 165th, 345th, 525th, 465th, 381st, 213th, 141st, 67th, 163rd, 343rd, 523rd, 463rd, 379th, 211th, 139th, 71st, 167th, 347th, 527th, 467th, 383rd, 215th, and 143rd, respectively;

(9) the 1st to 24th pixels composing the ninth row of the rectangular pattern are turned on 237th, 189th, 261st, 387th, 531st, 477th, 417th, 357th, 235th, 187th, 259th, 385th, 529th, 475th, 415th, 355th, 239th, 191st, 263rd, 389th, 533rd, 479th, 419th, and 359th, respectively;

(10) the 1st to 24th pixels composing the 10th row of the rectangular pattern are turned on 429th, 243rd, 171st, 219th, 267th, 399th, 435th, 549th, 427th, 241st, 169th, 217th, 265th, 397th, 433rd, 547th, 431st, 245th, 173rd, 221st, 269th, 401st, 437th, and 551st, respectively;

(11) the 1st to 24th pixels composing the 11th row of the rectangular pattern are turned on 507th, 279th, 147th, 51st, 99th, 195th, 363rd, 447th, 505th, 277th, 145th, 49th, 97th, 193rd, 361st, 445th, 509th, 281st, 149th, 53rd, 101st, 197th, 365th, and 449th, respectively;

(12) the 1st to 24th pixels composing the twelfth row of the rectangular pattern are turned on 555th, 291st, 75th, 3rd, 27th, 111th, 303rd, 483rd, 553rd, 289th, 73rd, 1st, 25th, 109th, 301st, 481st, 557th, 293rd, 77th, 5th, 29th, 113th, 305th, and 485th, respectively;

(13) the 1st to 24th pixels composing the 13th row of the rectangular pattern are turned on 498th, 318th, 126th, 42nd, 18th, 90th, 330th, 570th, 494th, 314th, 122nd, 38th, 14th, 86th, 326th, 566th, 496th, 316th, 124th, 40th, 16th, 88th, 328th, and 568th, respectively;

(14) the 1st to 24th pixels composing the 14th row of the rectangular pattern are turned on 462nd, 378th, 210th, 138th, 66th, 162nd, 342nd, 522nd, 458th, 374th, 206th, 134th, 62nd, 158th, 338th, 518th, 460th, 376th, 208th, 136th, 64th, 160th, 340th, and 520th, respectively;

(15) the 1st to 24th pixels composing the 15th row of the rectangular pattern are turned on 540th, 474th, 414th, 354th, 234th, 186th, 258th, 396th, 536th, 470th, 410th, 350th, 230th, 182nd, 254th, 392nd, 538th, 472nd, 412th, 352nd, 232nd, 184th, 256th, and 394th, respectively;

(16) the 1st to 24th pixels composing the 16th row of the rectangular pattern are turned on 276th, 408th, 444th, 546th, 426th, 252nd, 180th, 228th, 272nd, 404th, 440th, 542nd, 422nd, 248th, 176th, 224th, 274th, 406th, 442nd, 544th, 424th, 250th, 178th, and 226th, respectively;

(17) the 1st to 24th pixels composing the 17th row of the rectangular pattern are turned on 108th, 204th, 372nd, 456th, 516th, 288th, 156th, 60th, 104th, 200th, 368th, 452nd, 512th, 284th, 152nd, 56th, 106th, 202nd, 370th, 454th, 514th, 286th, 154th, and 58th, respectively;

(18) the 1st to 24th pixels composing the 18th row of the rectangular pattern are turned on 36th, 120th, 312th, 492nd,

564th, 300th, 84th, 12th, 32nd, 116th, 308th, 488th, 560th, 296th, 80th, 8th, 34th, 118th, 310th, 490th, 562nd, 298th, 82nd, and 10th, respectively;

(19) the 1st to 24th pixels composing the 19th row of the rectangular pattern are turned on 24th, 96th, 336th, 576th, 504th, 324th, 132nd, 48th, 20th, 92nd, 332nd, 572nd, 500th, 320th, 128th, 44th, 22nd, 94th, 334th, 574th, 502nd, 322nd, 130th, and 46th, respectively;

(20) the 1st to 24th pixels composing the 20th row of the rectangular pattern are turned on 72nd, 168th, 348th, 528th, 468th, 384th, 216th, 144th, 68th, 164th, 344th, 524th, 464th, 380th, 212th, 140th, 70th, 166th, 346th, 526th, 466th, 382nd, 214th, and 142nd, respectively;

(21) the 1st to 24th pixels composing the 21st row of the rectangular pattern are turned on 240th, 192nd, 264th, 390th, 534th, 480th, 420th, 360th, 236th, 188th, 260th, 386th, 530th, 476th, 416th, 356th, 238th, 190th, 262nd, 388th, 532nd, 478th, 418th, and 358th, respectively;

(22) the 1st to 24th pixels composing the 22nd row of the rectangular pattern are turned on 432nd, 246th, 174th, 222nd, 270th, 402nd, 438th, 552nd, 428th, 242nd, 170th, 218th, 266th, 398th, 434th, 548th, 430th, 244th, 172nd, 220th, 268th, 400th, 436th, and 550th, respectively;

(23) the 1st to 24th pixels composing the 23rd row of the rectangular pattern are turned on 510th, 282nd, 150th, 54th, 102nd, 198th, 366th, 450th, 506th, 278th, 146th, 50th, 98th, 194th, 362nd, 446th, 508th, 280th, 148th, 52nd, 100th, 196th, 364th, and 448th, respectively;

(24) the 1st to 24th pixels composing the 24th row of the rectangular pattern are turned on 558th, 294th, 78th, 6th, 30th, 114th, 306th, 486th, 554th, 290th, 74th, 2nd, 26th, 110th, 302nd, 482nd, 556th, 292nd, 76th, 4th, 28th, 112th, 304th, and 484th, respectively.

Furthermore, in binary-form dither matrix patterns **12a** through **12p** used in a printer of the above-described embodiment, the pixels are turned on in descending numeric order. The present invention should by no means be limited to this. The turning-on sequence may be reversed, so that the pixels are turned on as numbered.

FIG. 19 through FIG. 34 show other modified examples of binary-coding patterns for use in printers of one embodiment of the present invention. The turning-on sequence shown in binary-coding pattern **12a'** of FIG. 19 is the reverse of the turning-on sequence shown in binary-coding pattern **12a** of FIG. 4. Likewise, the turning-on sequence shown in binary-coding patterns, **12b'**, **12c'**, **12d'**, **12e'**, **12f'**, **12g'**, **12h'**, **12i'**, **12j'**, **12k'**, **12l'**, **12m'**, **12n'**, **12o'**, and **12p'**, of FIG. 20 through FIG. 34, respectively, is the reverse of the turning-on sequence shown in binary-coding patterns, **12b**, **12c**, **12d**, **12e**, **12f**, **12g**, **12h**, **12i**, **12j**, **12k**, **12l**, **12m**, **12n**, **12o**, and **12p**, of FIG. 5 through FIG. 18, respectively. In other words, in binary coding patterns, **12a'**, **12b'**, **12c'**, **12d'**, **12e'**, **12f'**, **12g'**, **12h'**, **12i'**, **12j'**, **12k'**, **12l'**, **12m'**, **12n'**, **12o'**, and **12p'**, of FIG. 19 through FIG. 34, the turning on of the pixels is carried out in ascending numeric order, and thereby these binary-coding patterns function as dot clustered binary-coding patterns (dither patterns, binary-form dither matrix patterns).

With use of a binary-coding pattern, **12a'** through **12h'**, it is possible to represent the pixel values (e.g., 0 to 255) of the individual pixels of an object multilevel image (original image) in 96 levels of gray. Using binary-coding pattern, **12i'** through **12p'**, it is possible to represent the pixel values of the pixels of an object multilevel image (original image) in 576 levels of gray. For the sake of convenience, some of the unit patterns are diagonally shaded in FIG. 19 through FIG. 34.

As illustrated in binary-coding patterns, **12b**, **12d**, **12f**, **12h**, **12j**, **12l**, **12n**, **12p**, **12b'**, **12d'**, **12f'**, **12h'**, **12j'**, **12l'**, **12n'**, **12p'** of FIG. 4, FIG. 6, FIG. 8, FIG. 10, FIG. 12, FIG. 14, FIG. 16, FIG. 18, FIG. 20, FIG. 22, FIG. 24, FIG. 26, FIG. 28, FIG. 30, FIG. 32, and FIG. 34, respectively, the sequence of turning on the pixels is set in such a way that a dot having a roughly oval shape grows in each unit pattern, **12bb**, **12dd**, **12ff**, **12hh**, **12jj**, **12ll**, **12nn**, **12pp**, **12bb'**, **12dd'**, **12ff'**, **12hh'**, **12jj'**, **12ll'**, **12nn'**, and **12pp'**. Hence it is possible to absorb displacement, if any, caused for any reason in image forming unit **15** of a printer, thereby ensuring high-quality printouts.

Further, as illustrated in binary-coding patterns, **12a**, **12b**, **12c**, **12d**, **12i**, **12j**, **12k**, **12l**, **12a'**, **12b'**, **12c'**, **12d'**, **12i'**, **12j'**, **12k'**, and **12l'**, of FIG. 2, FIG. 4 through FIG. 6, FIG. 11 through FIG. 14, FIG. 19 through FIG. 22, and FIG. 27 through FIG. 30, respectively, the sequence of turning on the pixels is set in such a way that, in each unit pattern, **12aa**, **12bb**, **12cc**, **12dd**, **12ii**, **12jj**, **12kk**, **12ll**, **12aa'**, **12bb'**, **12cc'**, **12dd'**, **12ii'**, **12jj'**, **12kk'**, and **12ll'**, two pixels disposed diametrically symmetrically to one another with respect to the center of the unit pattern are first turned on successively. It is thus possible to minimize moiré and other artifacts, thereby ensuring high-quality printouts.

Still further, as illustrated in binary-coding pattern **12e**, **12f**, **12g**, **12h**, **12m**, **12n**, **12o**, **12p**, **12e'**, **12f'**, **12g'**, **12h'**, **12m'**, **12n'**, **12o'**, and **12p'**, of FIG. 7 through FIG. 10, FIG. 15 through FIG. 18, FIG. 23 through FIG. 26, and FIG. 31 through FIG. 34, respectively, the sequence of turning on the pixels is set in such a way that, in each unit pattern, **12ee**, **12ff**, **12gg**, **12hh**, **12mm**, **12nn**, **12oo**, **12pp**, **12ee'**, **12ff'**, **12gg'**, **12hh'**, **12mm'**, **12nn'**, **12oo'**, and **12pp'**, two pixels adjoining one another and being disposed adjacently to the center of the unit pattern are first turned on successively. As a result, such neighboring spots of color material fix with one another, so that the fixing of color material to a printing medium would be facilitated, thereby ensuring high-quality printouts.

Moreover, the order of turning-on that is set for an arbitrary pixel in binary-coding pattern, **12a** through **12p** and **12a'** through **12p'**, and the order of turning-on that is set for the pixel disposed in a position diametrically symmetrical to the arbitrary pixel with respect to the center of binary-coding pattern, **12a** through **12p** and **12a'** through **12p'**, or to the center of each unit pattern, **12aa** through **12pp** and **12aa'** through **12pp'**, can be substituted for each other.

Using the forgoing binary-coding pattern, **12b** through **12p** and **12a'** through **12p'**, dot data generating unit **14** selects the pixels of binary-coding pattern, **12b** through **12p** and **12a'** through **12p'**, in accordance with the given turning-on sequence, from the start pixel to the pixel which is numbered a predetermined sequence number, so that the pixels on which color material is to be formed are determined, thereby generating dot data. In accordance with the thus generated dot data, image forming unit **15** forms (prints) the image (image forming step).

Further, the foregoing color operation unit **10**, image signal memory **11**, gradation characteristics changing unit **13**, pattern memory **12**, and dot data generating unit **14** may be provided outside the present printer (for example, a computer (not shown) coupled with the present printer). The computer executes programs (including the one for creating the aforementioned binary-coding pattern, **12a** through **12** and **12a'** through **12p'**), thereby serving as at least some of the above-mentioned color operation unit **10**, image signal memory **11**, gradation characteristics changing unit **13**, pattern memory **12**, and dot data generating unit **14**.

What is claimed is:

1. A method of printing a given multivalued image in a binary-form output pattern, said method comprising the steps of: (a) providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; (b) expanding the given multivalued image in a memory area of a storage device; and (c) forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image which has been expanded in the memory area, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

2. A printing method according to claim **1**, further comprising the step of changing said sequence of turning on said plural pattern elements using a look-up table.

3. A method of printing a given multivalued image in a binary-form output pattern, said method comprising the steps of: (a) providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; and (b) forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

4. A printing method according to claim **3**, further comprising the step of changing said sequence of turning on said plural pattern elements using a look-up table.

5. An apparatus for printing a given multivalued image in a binary-form output pattern, said apparatus comprising: (a) means for providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which dot elements are substantially identical in shape, grow successively from a

plurality of local points associated with the respective groups and successively from a center dot element in each group; (b) a storage device having a memory area in which the given multivalued image is to be expanded; and (c) means for forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image which has been expanded in the memory area, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

6. A printing apparatus according to claim 5, further comprising a turning-on sequence changing section for changing said sequence of turning on said plural pattern elements using a look-up table.

7. An apparatus for printing a given multivalued image in a binary-form output pattern, said apparatus comprising: (a) means for providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which dot elements are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; and (b) means for forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

8. A printing apparatus according to claim 7, further comprising a turning-on sequence changing section for changing said sequence of turning on said plural pattern elements using a look-up table.

9. A computer-readable recording medium in which a program for controlling the printing of a given multivalued image in a binary-form output pattern is recorded, wherein said printing program instructs a computer to execute the following steps of: (a) providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; (b) expanding the given multivalued image in a memory area of a storage device; and (c) forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the indi-

vidual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image which has been expanded in the memory area, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

10. A computer-readable recording medium according to claim 9, wherein said printing program further instructs the computer to execute the step of changing said sequence of turning on said plural pattern elements using a look-up table.

11. A computer-readable recording medium in which a program for controlling the printing of a given multivalued image in a binary-form output pattern is recorded, wherein said printing program instructs a computer to execute the following steps of: (a) providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; and (b) forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

12. A computer-readable recording medium according to claim 11, wherein said printing program further instructs the computer to execute the step of changing said sequence of turning on said plural pattern elements using a look-up table.

13. A computer-readable recording medium in which a program for converting a given multivalued image into a binary image is recorded, wherein said binarizing program instructs a computer to execute the following steps of: (a) providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; (b) expanding the given multivalued image in a memory area of a storage device; and (c) forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image which has been expanded in the memory area, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow

successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

14. A computer-readable recording medium according to claim 13, wherein said binarizing program further instructs the computer to execute the step of changing said sequence of turning on said plural pattern elements using a look-up table.

15. A computer-readable recording medium in which a program for converting a given multivalued image into a binary image is recorded, wherein said binarizing program instructs a computer to execute the following steps of: (a) providing a binary-form dither matrix pattern which is used to obtain the binary-form output pattern, said binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group; and (b) forming a binary image of said output dot elements in accordance with said binary-form output pattern obtained by turning on the individual pattern elements of said binary-form dither matrix pattern, based on the given multivalued image, in such a manner that said output dot elements of an individual print dot of the binary image which correspond to said pattern elements of said binary-form dither matrix pattern grow successively from said center dot element at the associated local point in each group in the sequence the corresponding pattern elements of said binary-form dither matrix pattern are numbered.

16. A computer-readable recording medium according to claim 15, wherein said binarizing program further instructs the computer to execute the step of changing said sequence of turning on said plural pattern elements using a look-up table.

17. A computer-readable medium encoded with a data structure used for printing a given multivalued image in a binary-form output pattern, comprising:

a binary-form dither matrix pattern having a rectangular pattern in which a plurality of pattern elements that are numbered to be successively turned on are arranged in matrix, the sequence of turning on of said plural pattern elements being set in such a way that a plurality of groups of prospective output dot elements, which groups are substantially identical in shape, grow successively from a plurality of local points associated with the respective groups and successively from a center dot element in each group,

wherein said rectangular pattern is composed of 96 pattern elements arranged in a matrix of 8 rows×12 columns that are turned on in the following manner: the 1st to 12th pattern elements composing the first row of the rectangular pattern are turned on 4th, 20th, 44th, 76th, 81st, 49th, 53rd, 85th, 80th, 48th, 24th, and 8th, respectively; the 1st to 12th pattern elements composing the second row of the rectangular pattern are turned on 12th, 28th, 68th, 89th, 57th, 33rd, 37th, 61st, 93rd, 72nd, 32nd, and 16th, respectively; the 1st to 12th pattern elements composing the third row of the rectangular pattern are turned on 36th, 60th, 92nd, 65th, 25th, 9th, 13th, 29th, 69th, 96th, 64th, and 40th, respectively; the 1st to 12th pattern elements composing the

fourth row of the rectangular pattern are turned on 52nd, 84th, 73rd, 41st, 17th, 1st, 5th, 21st, 45th, 77th, 88th, and 56th, respectively; the 1st to 12th pattern elements composing the fifth row of the rectangular pattern are turned on 54th, 86th, 79th, 47th, 23rd, 7th, 3rd, 19th, 43rd, 75th, 82nd, and 50th, respectively; the 1st to 12th pattern elements composing the sixth row of the rectangular pattern are turned on 38th, 62nd, 94th, 71st, 31st, 15th, 11th, 27th, 67th, 90th, 58th, and 34th, respectively; the 1st to 12th pattern elements composing the seventh row of the rectangular pattern are turned on 14th, 30th, 70th, 95th, 63rd, 39th, 35th, 59th, 91st, 66th, 26th, and 10th, respectively; and the 1st to 12th pattern elements composing the eighth row of the rectangular pattern are turned on 6th, 22nd, 46th, 78th, 87th, 55th, 51st, 83rd, 74th, 42nd, 18th, and 2nd, respectively.

18. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 96 pattern elements arranged in a matrix of 8 rows×12 columns that are turned on in the following manner: the 1st to 12th pattern elements composing the first row of the rectangular pattern are turned on 4th, 20th, 52nd, 84th, 73rd, 41st, 45th, 77th, 88th, 56th, 24th, and 8th, respectively; the 1st to 12th pattern elements composing the second row of the rectangular pattern are turned on 12th, 36th, 68th, 89th, 57th, 25th, 29th, 61st, 93rd, 72nd, 40th, and 16th, respectively; the 1st to 12th pattern elements composing the third row of the rectangular pattern are turned on 28th, 60th, 92nd, 65th, 33rd, 9th, 13th, 37th, 69th, 96th, 64th, and 32nd, respectively; the 1st to 12th pattern elements composing the fourth row of the rectangular pattern are turned on 44th, 76th, 81st, 49th, 17th, 1st, 5th, 21st, 53rd, 85th, 80th, and 48th, respectively; the 1st to 12th pattern elements composing the fifth row of the rectangular pattern are turned on 46th, 78th, 87th, 55th, 23rd, 7th, 3rd, 19th, 51st, 83rd, 74th, and 42nd, respectively; the 1st to 12th pattern elements composing the sixth row of the rectangular pattern are turned on 30th, 62nd, 94th, 71st, 39th, 15th, 11th, 35th, 67th, 90th, 58th, and 26th, respectively; the 1st to 12th pattern elements composing the seventh row of the rectangular pattern are turned on 14th, 38th, 70th, 95th, 63rd, 31st, 27th, 59th, 91st, 66th, 34th, and 10th, respectively; and the 1st to 12th pattern elements composing the eighth row of the rectangular pattern are turned on 6th, 22nd, 54th, 86th, 79th, 47th, 43rd, 75th, 82nd, 50th, 18th, and 2nd, respectively.

19. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 96 pattern elements arranged in a matrix of 12 rows×8 columns that are turned on in the following manner: the 1st to 8th pattern elements composing the first row of the rectangular pattern are turned on 83rd, 47th, 15th, 7th, 3rd, 23rd, 55th, and 95th, respectively; the 1st to 8th pattern elements composing the second row of the rectangular pattern are turned on 67th, 43rd, 31st, 19th, 11th, 27th, 75th, and 91st, respectively; the 1st to 8th pattern elements composing the third row of the rectangular pattern are turned on 86th, 63rd, 71st, 51st, 39th, 35th, 59th, and 78th, respectively; the 1st to 8th pattern elements composing the fourth row of the rectangular pattern are turned on 50th, 70th, 62nd, 87th, 79th, 58th, 34th, and 38th, respectively; the 1st to 8th pattern elements composing the fifth row of the rectangular pattern are turned on 18th, 30th, 42nd, 66th, 90th, 74th, 26th, and 10th, respectively; the 1st to 8th pattern elements composing the sixth row of the rectangular pattern are turned on 6th, 14th, 46th, 82nd, 94th, 54th, 22nd, and 2nd, respectively; the 1st to 8th pattern elements composing the seventh row of the

rectangular pattern are turned on 4th, 24th, 56th, 96th, 84th, 48th, 16th, and 8th, respectively; the 1st to 8th pattern elements composing the eighth row of the rectangular pattern are turned on 12th, 28th, 76th, 92nd, 68th, 44th, 32nd, and 20th, respectively; the 1st to 8th pattern elements composing the ninth row of the rectangular pattern are turned on 40th, 36th, 60th, 77th, 85th, 64th, 72nd, and 52nd, respectively; the 1st to 8th pattern elements composing the 10th row of the rectangular pattern are turned on 80th, 57th, 33rd, 37th, 49th, 69th, 61st, and 88th, respectively; the 1st to 8th pattern elements composing the 11th row of the rectangular pattern are turned on 89th, 73rd, 25th, 9th, 17th, 29th, 41st, and 65th, respectively; and the 1st to 8th pattern elements composing the twelfth row of the rectangular pattern are turned on 93rd, 53rd, 21st, 1st, 5th, 13th, 45th, and 81st, respectively.

20. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 96 pattern elements arranged in a matrix of 12 rows×8 columns that are turned on in the following manner: the 1st to 8th pattern elements composing the first row of the rectangular pattern are turned on 83rd, 59th, 23rd, 7th, 3rd, 15th, 55th, and 95th, respectively; the 1st to 8th pattern elements composing the second row of the rectangular pattern are turned on 79th, 63rd, 35th, 19th, 11th, 27th, 51st, and 87th, respectively; the 1st to 8th pattern elements composing the third row of the rectangular pattern are turned on 90th, 75th, 71st, 47th, 39th, 31st, 43rd, and 66th, respectively; the 1st to 8th pattern elements composing the fourth row of the rectangular pattern are turned on 46th, 70th, 74th, 91st, 67th, 42nd, 30th, and 38th, respectively; the 1st to 8th pattern element composing the fifth row of the rectangular pattern are turned on 18th, 34th, 62nd, 78th, 86th, 50th, 26th, and 10th, respectively; the 1st to 8th pattern elements composing the sixth row of the rectangular pattern are turned on 6th, 22nd, 58th, 82nd, 94th, 54th, 14th, and 2nd, respectively; the 1st to 8th pattern elements composing the seventh row of the rectangular pattern are turned on 4th, 16th, 56th, 96th, 84th, 60th, 24th, and 8th, respectively; the 1st to 8th pattern elements composing the eighth row of the rectangular pattern are turned on 12th, 28th, 52nd, 88th, 80th, 64th, 36th, and 20th, respectively; the 1st to 8th pattern elements composing the ninth row of the rectangular pattern are turned on 40th, 32nd, 44th, 65th, 89th, 76th, 72nd, and 48th, respectively; the 1st to 8th pattern elements composing the 10th row of the rectangular pattern are turned on 68th, 41st, 29th, 37th, 45th, 69th, 73rd, and 92nd, respectively; the 1st to 8th pattern elements composing the 11th row of the rectangular pattern are turned on 85th, 49th, 25th, 9th, 17th, 33rd, 61st, and 77th, respectively; and the 1st to 8th pattern elements composing the twelfth row of the rectangular pattern are turned on 93rd, 53rd, 13th, 1st, 5th, 21st, 57th, and 81st, respectively.

21. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 96 pattern elements arranged in a matrix of 8 rows×12 columns that are turned on in the following manner: the 1st to 12th pattern elements composing the first row of the rectangular pattern are turned on 8th, 20th, 44th, 68th, 81st, 49th, 51st, 83rd, 66th, 42nd, 18th, and 6th, respectively; the 1st to 12th pattern elements composing the second row of the rectangular pattern are turned on 24th, 32nd, 72nd, 89th, 53rd, 33rd, 35th, 55th, 91st, 70th, 30th, and 22nd, respectively; the 1st to 12th pattern elements composing the third row of the rectangular pattern are turned on 48th, 76th, 96th, 57th, 25th, 9th, 11th, 27th, 59th, 94th, 74th, and 46th, respectively; the 1st to 12th pattern elements composing the fourth row of the

rectangular pattern are turned on 80th, 88th, 61st, 37th, 13th, 1st, 3rd, 15th, 39th, 63rd, 86th, and 78th, respectively; the 1st to 12th pattern elements composing the fifth row of the rectangular pattern are turned on 52nd, 84th, 65th, 41st, 17th, 5th, 7th, 19th, 43rd, 67th, 82nd, and 50th, respectively; the 1st to 12th pattern elements composing the sixth row of the rectangular pattern are turned on 36th, 56th, 92nd, 69th, 29th, 21st, 23rd, 31st, 71st, 90th, 54th, and 34th, respectively; the 1st to 12th pattern elements composing the seventh row of the rectangular pattern are turned on 12th, 28th, 60th, 93rd, 73rd, 45th, 47th, 75th, 95th, 58th, 26th, and 10th, respectively; and the 1st to 12th pattern elements composing the eighth row of the rectangular pattern are turned on 4th, 16th, 40th, 64th, 85th, 77th, 79th, 87th, 62nd, 38th, 14th, and 2nd, respectively.

22. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 96 pattern elements arranged in a matrix of 8 rows×12 columns that are turned on in the following manner: the 1st to 12th pattern elements composing the first row of the rectangular pattern are turned on 8th, 24th, 56th, 88th, 73rd, 41st, 43rd, 75th, 86th, 54th, 22nd, and 6th, respectively; the 1st to 12th pattern elements composing the second row of the rectangular pattern are turned on 16th, 36th, 72nd, 89th, 57th, 25th, 27th, 59th, 91st, 70th, 34th, and 14th, respectively; the 1st to 12th pattern elements composing the third row of the rectangular pattern are turned on 40th, 64th, 96th, 65th, 29th, 9th, 11th, 31st, 67th, 94th, 62nd, and 38th, respectively; the 1st to 12th pattern elements composing the fourth row of the rectangular pattern are turned on 48th, 80th, 81st, 49th, 17th, 1st, 3rd, 19th, 51st, 83rd, 78th, and 46th, respectively; the 1st to 12th pattern elements composing the fifth row of the rectangular pattern are turned on 44th, 76th, 85th, 53rd, 21st, 5th, 7th, 23rd, 55th, 87th, 74th, and 42nd, respectively; the 1st to 12th pattern elements composing the sixth row of the rectangular pattern are turned on 28th, 60th, 92nd, 69th, 33rd, 13th, 15th, 35th, 71st, 90th, 58th, and 26th, respectively; the 1st to 12th pattern elements composing the seventh row of the rectangular pattern are turned on 12th, 32nd, 68th, 93rd, 61st, 37th, 39th, 63rd, 95th, 66th, 30th, and 10th, respectively; and the 1st to 12th pattern elements composing the eighth row of the rectangular pattern are turned on 4th, 20th, 52nd, 84th, 77th, 45th, 47th, 79th, 82nd, 50th, 18th, and 2nd, respectively.

23. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 96 pattern elements arranged in a matrix of 12 rows×8 columns that are turned on in the following manner: the 1st to 8th pattern elements composing the first row of the rectangular pattern are turned on 81st, 41st, 13th, 5th, 7th, 21st, 53rd, and 91st, respectively; the 1st to 8th pattern elements composing the second row of the rectangular pattern are turned on 63rd, 43rd, 29th, 23rd, 15th, 31st, 73rd, and 93rd, respectively; the 1st to 8th pattern elements composing the third row of the rectangular pattern are turned on 86th, 65th, 75th, 55th, 45th, 47th, 67th, and 78th, respectively; the 1st to 8th pattern elements composing the fourth row of the rectangular pattern are turned on 50th, 70th, 60th, 95th, 83rd, 58th, 34th, and 36th, respectively; the 1st to 8th pattern elements composing the fifth row of the rectangular pattern are turned on 18th, 28th, 38th, 62nd, 88th, 72nd, 26th, and 10th, respectively; the 1st to 8th pattern elements composing the sixth row of the rectangular pattern are turned on 4th, 12th, 40th, 80th, 90th, 52nd, 20th, and 2nd, respectively; the 1st to 8th pattern elements composing the seventh row of the rectangular pattern are turned on 8th, 22nd, 54th, 92nd, 82nd, 42nd, 14th, 6th, respectively; the 1st to 8th pattern

elements composing the eighth row of the rectangular pattern are turned on 16th, 32nd, 74th, 94th, 64th, 44th, 30th, and 24th, respectively; the 1st to 8th pattern elements composing the ninth row of the rectangular pattern are turned on 46th, 48th, 68th, 77th, 85th, 66th, 76th, and 56th, respectively; the 1st to 8th pattern elements composing the 10th row of the rectangular pattern are turned on 84th, 57th, 33rd, 35th, 49th, 69th, 59th, and 96th, respectively; the 1st to 8th pattern elements composing the 11th row of the rectangular pattern are turned on 87th, 71st, 25th, 9th, 17th, 27th, 37th, and 61st, respectively; and the 1st to 8th pattern elements composing the twelfth row of the rectangular pattern are turned on 89th, 51st, 19th, 1st, 3rd, 11th, 39th, and 79th, respectively.

24. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 96 pattern elements arranged in a matrix of 12 rows×8 columns that are turned on in the following manner: the 1st to 8th pattern elements composing the first row of the rectangular pattern are turned on 83rd, 53rd, 21st, 7th, 3rd, 15th, 55th, and 95th, respectively; the 1st to 8th pattern elements composing the second row of the rectangular pattern are turned on 77th, 63rd, 35th, 23rd, 11th, 27th, 57th, and 87th, respectively; the 1st to 8th pattern elements composing the third row of the rectangular pattern are turned on 90th, 79th, 69th, 59th, 39th, 31st, 43rd, and 66th, respectively; the 1st to 8th pattern elements composing the fourth row of the rectangular pattern are turned on 46th, 68th, 74th, 91st, 71st, 42nd, 30th, and 38th, respectively; the 1st to 8th pattern elements composing the fifth row of the rectangular pattern are turned on 18th, 34th, 62nd, 76th, 86th, 48th, 26th, and 10th, respectively; the 1st to 8th pattern elements composing the sixth row of the rectangular pattern are turned on 6th, 20th, 52nd, 82nd, 94th, 50th, 14th, 2nd, respectively; the 1st to 8th pattern elements composing the seventh row of the rectangular pattern are turned on 4th, 16th, 56th, 96th, 84th, 54th, 22nd, and 8th, respectively; the 1st to 8th pattern elements composing the eighth row of the rectangular pattern are turned on 12th, 28th, 58th, 88th, 78th, 64th, 36th, and 24th, respectively; the 1st to 8th pattern elements composing the ninth row of the rectangular pattern are turned on 40th, 32nd, 44th, 65th, 89th, 80th, 70th, and 60th, respectively; the 1st to 8th pattern elements composing the 10th row of the rectangular pattern are turned on 72nd, 41st, 29th, 37th, 45th, 67th, 73rd, and 92nd, respectively; the 1st to 8th pattern elements composing the 11th row of the rectangular pattern are turned on 85th, 47th, 25th, 9th, 17th, 33rd, 61st, and 75th, respectively; and the 1st to 8th pattern elements composing the twelfth row of the rectangular pattern are turned on 93rd, 49th, 13th, 1st, 5th, 19th, 51st, and 81st, respectively.

25. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 576 pattern elements arranged in a matrix of 24 rows×24 columns that are turned on in the following manner: the 1st to 24th pattern elements composing the first row of the rectangular pattern are turned on 317th, 509th, 479th, 287th, 143rd, 47th, 23rd, 119th, 263rd, 455th, 485th, 293rd, 316th, 508th, 478th, 286th, 142nd, 46th, 22nd, 118th, 262nd, 454th, 484th, and 292nd, respectively; the 1st to 24th pattern elements composing the second row of the rectangular pattern are turned on 221st, 365th, 557th, 431st, 191st, 95th, 71st, 167th, 407th, 533rd, 341st, 197th, 220th, 364th, 556th, 430th, 190th, 94th, 70th, 166th, 406th, 532nd, 340th, and 196th, respectively; the 1st to 24th pattern elements composing the third row of the rectangular pattern are turned on 77th, 173rd, 413th, 575th, 383rd, 239th, 215th, 359th, 551st,

389th, 149th, 53rd, 76th, 172nd, 412th, 574th, 382nd, 238th, 214th, 358th, 550th, 388th, 148th, 52nd, respectively; the 1st to 24th pattern elements composing the fourth row of the rectangular pattern are turned on 29th, 125th, 269th, 461st, 527th, 335th, 311th, 503rd, 437th, 245th, 101st, 5th, 28th, 124th, 268th, 460th, 526th, 334th, 310th, 502nd, 436th, 244th, 100th, and 4th, respectively; the 1st to 24th pattern elements composing the fifth row of the rectangular pattern are turned on 17th, 113th, 257th, 449th, 491st, 299th, 323rd, 515th, 473rd, 281st, 137th, 41st, 16th, 112th, 256th, 448th, 490th, 298th, 322nd, 514th, 472nd, 280th, 136th, and 40th, respectively; the 1st to 24th pattern elements composing the sixth row of the rectangular pattern are turned on 65th, 161st, 401st, 539th, 347th, 203rd, 227th, 371st, 563rd, 425th, 185th, 89th, 64th, 160th, 400th, 538th, 346th, 202nd, 226th, 370th, 562nd, 424th, 184th, and 88th, respectively; the 1st to 24th pattern elements composing the seventh row of the rectangular pattern are turned on 209th, 353rd, 545th, 395th, 155th, 59th, 83rd, 179th, 419th, 569th, 377th, 233rd, 208th, 352nd, 544th, 394th, 154th, 58th, 82nd, 178th, 418th, 568th, 376th, and 232nd, respectively; the 1st to 24th pattern elements composing the eighth row of the rectangular pattern are turned on 305th, 497th, 443rd, 251st, 107th, 11th, 35th, 131st, 275th, 467th, 521st, 329th, 304th, 496th, 442nd, 250th, 106th, 10th, 34th, 130th, 274th, 466th, 520th, and 328th, respectively; the 1st to 24th pattern elements composing the ninth row of the rectangular pattern are turned on 313th, 505th, 475th, 283rd, 139th, 43rd, 19th, 115th, 259th, 451st, 481st, 289th, 314th, 506th, 476th, 284th, 140th, 44th, 20th, 116th, 260th, 452nd, 482nd, and 290th, respectively; the 1st to 24th pattern elements composing the 10th row of the rectangular pattern are turned on 217th, 361st, 553rd, 427th, 187th, 91st, 67th, 163rd, 403rd, 529th, 337th, 193rd, 218th, 362nd, 554th, 428th, 188th, 92nd, 68th, 164th, 404th, 530th, 338th, and 194th, respectively; the 1st to 24th pattern elements composing the 11th row of the rectangular pattern are turned on 73rd, 169th, 409th, 571st, 379th, 235th, 211th, 355th, 547th, 385th, 145th, 49th, 74th, 170th, 410th, 572nd, 380th, 236th, 212th, 356th, 548th, 386th, 146th, and 50th, respectively; the 1st to 24th pattern elements composing the twelfth row of the rectangular pattern are turned on 25th, 121st, 265th, 457th, 523rd, 331st, 307th, 499th, 433rd, 241st, 97th, 1st, 26th, 122nd, 266th, 458th, 524th, 332nd, 308th, 500th, 434th, 242nd, 98th, and 2nd, respectively; the 1st to 24th pattern elements composing the 13th row of the rectangular pattern are turned on 13th, 109th, 253rd, 445th, 487th, 295th, 319th, 511th, 469th, 277th, 133rd, 37th, 14th, 110th, 254th, 446th, 488th, 296th, 320th, 512th, 470th, 278th, 134th, and 38th, respectively; the 1st to 24th pattern elements composing the 14th row of the rectangular pattern are turned on 61st, 157th, 397th, 535th, 343rd, 199th, 223rd, 367th, 559th, 421st, 181st, 85th, 62nd, 158th, 398th, 536th, 344th, 200th, 224th, 368th, 560th, 422nd, 182nd, and 86th, respectively; the 1st to 24th pattern elements composing the 15th row of the rectangular pattern are turned on 205th, 349th, 541st, 391st, 151st, 55th, 79th, 175th, 415th, 565th, 373rd, 229th, 206th, 350th, 542nd, 392nd, 152nd, 56th, 80th, 176th, 416th, 566th, 374th, and 230th, respectively; the 1st to 24th pattern elements composing the 16th row of the rectangular pattern are turned on 301st, 493rd, 439th, 247th, 103rd, 7th, 31st, 127th, 271st, 463rd, 517th, 325th, 302nd, 494th, 440th, 248th, 104th, 8th, 32nd, 128th, 272nd, 464th, 518th, and 326th, respectively; the 1st to 24th pattern elements composing the 17th row of the rectangular pattern are turned on 315th, 507th, 477th, 285th, 141st, 45th, 21st, 117th, 261st, 453rd, 483rd, 291st, 318th, 510th, 480th, 288th, 144th, 48th, 24th, 120th, 264th, 456th, 486th, and

294th, respectively; the 1st to 24th pattern elements composing the 18th row of the rectangular pattern are turned on 219th, 363rd, 555th, 429th, 189th, 93rd, 69th, 165th, 405th, 531st, 339th, 195th, 222nd, 366th, 558th, 432nd, 192nd, 96th, 72nd, 168th, 408th, 534th, 342nd, and 198th, respectively; the 1st to 24th pattern elements composing the 19th row of the rectangular pattern are turned on 75th, 171st, 411th, 573rd, 381st, 237th, 213th, 357th, 549th, 387th, 147th, 51st, 78th, 174th, 414th, 576th, 384th, 240th, 216th, 360th, 552nd, 390th, 150th, and 54th, respectively; the 1st to 24th pattern elements composing the 20th row of the rectangular pattern are turned on 27th, 123rd, 267th, 459th, 525th, 333rd, 309th, 501st, 435th, 243rd, 99th, 3rd, 30th, 126th, 270th, 462nd, 528th, 336th, 312th, 504th, 438th, 246th, 102nd, and 6th, respectively; the 1st to 24th pattern elements composing the 21st row of the rectangular pattern are turned on 15th, 111th, 255th, 447th, 489th, 297th, 321st, 513th, 471st, 279th, 135th, 39th, 18th, 114th, 258th, 450th, 492nd, 300th, 324th, 516th, 474th, 282nd, 138th, and 42nd, respectively; the 1st to 24th pattern elements composing the 22nd row of the rectangular pattern are turned on 63rd, 159th, 399th, 537th, 345th, 201st, 225th, 369th, 561st, 423rd, 183rd, 87th, 66th, 162nd, 402nd, 540th, 348th, 204th, 228th, 372nd, 564th, 426th, 186th, and 90th, respectively; the 1st to 24th pattern elements composing the 23rd row of the rectangular pattern are turned on 207th, 351st, 543rd, 393rd, 153rd, 57th, 81st, 177th, 417th, 567th, 375th, 231st, 210th, 354th, 546th, 396th, 156th, 60th, 84th, 180th, 420th, 570th, 378th, and 234th, respectively; and the 1st to 24th pattern elements composing the 24th row of the rectangular pattern are turned on 303rd, 495th, 441st, 249th, 105th, 9th, 33rd, 129th, 273rd, 465th, 519th, 327th, 306th, 498th, 444th, 252nd, 108th, 12th, 36th, 132nd, 276th, 468th, 522nd, and 330th, respectively.

26. A computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 576 pattern elements arranged in a matrix of 24 rows×24 columns that are turned on in the following manner: the 1st to 24th pattern elements composing the first row of the rectangular pattern are turned on 269th, 461st, 527th, 335th, 143rd, 47th, 23rd, 119th, 311th, 503rd, 437th, 245th, 268th, 460th, 526th, 334th, 142nd, 46th, 22nd, 118th, 310th, 502nd, 436th, and 244th, respectively; the 1st to 24th pattern elements composing the second row of the rectangular pattern are turned on 173rd, 365th, 557th, 431st, 239th, 95th, 71st, 215th, 407th, 533rd, 341st, 149th, 172nd, 364th, 556th, 430th, 238th, 94th, 70th, 214th, 406th, 532nd, 340th, and 148th, respectively; the 1st to 24th pattern elements composing the third row of the rectangular pattern are turned on 77th, 221st, 413th, 575th, 383rd, 191st, 167th, 359th, 551st, 389th, 197th, 53rd, 76th, 220th, 412th, 574th, 382nd, 190th, 166th, 358th, 550th, 388th, 196th, and 52nd, respectively; the 1st to 24th pattern elements composing the fourth row of the rectangular pattern are turned on 29th, 125th, 317th, 509th, 479th, 287th, 263rd, 455th, 485th, 293rd, 101st, 5th, 28th, 124th, 316th, 508th, 478th, 286th, 262nd, 454th, 484th, 292nd, 100th, and 4th, respectively; the 1st to 24th pattern elements composing the fifth row of the rectangular pattern are turned on 17th, 113th, 305th, 497th, 443rd, 251st, 275th, 467th, 521st, 329th, 137th, 41st, 16th, 112th, 304th, 496th, 442nd, 250th, 274th, 466th, 520th, 328th, 136th, and 40th, respectively; the 1st to 24th pattern elements composing the sixth row of the rectangular pattern are turned on 65th, 209th, 401st, 539th, 347th, 155th, 179th, 371st, 563rd, 425th, 233rd, 89th, 64th, 208th, 400th, 538th, 346th, 154th, 178th, 370th, 562nd, 424th, 232nd, and 88th, respectively; the 1st to 24th pattern elements composing the seventh row

of the rectangular pattern are turned on 161st, 353rd, 545th, 395th, 203rd, 59th, 83rd, 227th, 419th, 569th, 377th, 185th, 160th, 352nd, 544th, 394th, 202nd, 58th, 82nd, 226th, 418th, 568th, 376th, and 184th, respectively; the 1st to 24th pattern elements composing the eighth row of the rectangular pattern are turned on 257th, 449th, 491st, 299th, 107th, 11th, 35th, 131st, 323rd, 515th, 473rd, 281st, 256th, 448th, 490th, 298th, 106th, 10th, 34th, 130th, 322nd, 514th, 472nd, and 280th, respectively; the 1st to 24th pattern elements composing the ninth row of the rectangular pattern are turned on 265th, 457th, 523rd, 331st, 139th, 43rd, 19th, 115th, 307th, 499th, 433rd, 241st, 266th, 458th, 524th, 332nd, 140th, 44th, 20th, 116th, 308th, 500th, 434th, and 242nd, respectively; the 1st to 24th pattern elements composing the 10th row of the rectangular pattern are turned on 169th, 361st, 553rd, 427th, 235th, 91st, 67th, 211th, 403rd, 529th, 337th, 145th, 170th, 362nd, 554th, 428th, 236th, 92nd, 68th, 212th, 404th, 530th, 338th, and 146th, respectively; the 1st to 24th pattern elements composing the 11th row of the rectangular pattern are turned on 73rd, 217th, 409th, 571st, 379th, 187th, 163rd, 355th, 547th, 385th, 193rd, 49th, 74th, 218th, 410th, 572nd, 380th, 188th, 164th, 356th, 548th, 386th, 194th, and 50th, respectively; the 1st to 24th pattern elements composing the twelfth row of the rectangular pattern are turned on 25th, 121st, 313th, 505th, 475th, 283rd, 259th, 451st, 481st, 289th, 97th, 1st, 26th, 122nd, 314th, 506th, 476th, 284th, 260th, 452nd, 482nd, 290th, 98th, and 2nd, respectively; the 1st to 24th pattern elements composing the 13th row of the rectangular pattern are turned on 13th, 109th, 301st, 493rd, 439th, 247th, 271st, 463rd, 517th, 325th, 133rd, 37th, 14th, 110th, 302nd, 494th, 440th, 248th, 272nd, 464th, 518th, 326th, 134th, and 38th, respectively; the 1st to 24th pattern elements composing the 14th row of the rectangular pattern are turned on 61st, 205th, 397th, 535th, 343rd, 151st, 175th, 367th, 559th, 421st, 229th, 85th, 62nd, 206th, 398th, 536th, 344th, 152nd, 176th, 368th, 560th, 422nd, 230th, and 86th, respectively; the 1st to 24th pattern elements composing the 15th row of the rectangular pattern are turned on 157th, 349th, 541st, 391st, 199th, 55th, 79th, 223rd, 415th, 565th, 373rd, 181st, 158th, 350th, 542nd, 392nd, 200th, 56th, 80th, 224th, 416th, 566th, 374th, and 182nd, respectively; the 1st to 24th pattern elements composing the 16th row of the rectangular pattern are turned on 253rd, 445th, 487th, 295th, 103rd, 7th, 31st, 127th, 319th, 511th, 469th, 277th, 254th, 446th, 488th, 296th, 104th, 8th, 32nd, 128th, 320th, 512th, 470th, and 278th, respectively; the 1st to 24th pattern elements composing the 17th row of the rectangular pattern are turned on 267th, 459th, 525th, 333rd, 141st, 45th, 21st, 117th, 309th, 501st, 435th, 243rd, 270th, 462nd, 528th, 336th, 144th, 48th, 24th, 120th, 312th, 504th, 438th, and 246th, respectively; the 1st to 24th pattern elements composing the 18th row of the rectangular pattern are turned on 171st, 363rd, 555th, 429th, 237th, 93rd, 69th, 213th, 405th, 531st, 339th, 147th, 174th, 366th, 558th, 432nd, 240th, 96th, 72nd, 216th, 408th, 534th, 342nd, and 150th, respectively; the 1st to 24th pattern elements composing the 19th row of the rectangular pattern are turned on 75th, 219th, 411th, 573rd, 381st, 189th, 165th, 357th, 549th, 387th, 195th, 51st, 78th, 222nd, 414th, 576th, 384th, 192nd, 168th, 360th, 552nd, 390th, 198th, and 54th, respectively; the 1st to 24th pattern elements composing the 20th row of the rectangular pattern are turned on 27th, 123rd, 315th, 507th, 477th, 285th, 261st, 453rd, 483rd, 291st, 99th, 3rd, 30th, 126th, 318th, 510th, 480th, 288th, 264th, 456th, 486th, 294th, 102nd, and 6th, respectively; the 1st to 24th pattern elements composing the 21st row of the rectangular pattern are turned on 15th, 111th, 303rd, 495th,

441st, 249th, 273rd, 465th, 519th, 327th, 135th, 39th, 18th, 114th, 306th, 498th, 444th, 252nd, 276th, 468th, 522nd, 330th, 138th, and 42nd, respectively; the 1st to 24th pattern elements composing the 22nd row of the rectangular pattern are turned on 63rd, 207th, 399th, 537th, 345th, 153rd, 177th, 369th, 561st, 423rd, 231st, 87th, 66th, 210th, 402nd, 540th, 348th, 156th, 180th, 372nd, 564th, 426th, 234th, and 90th, respectively; the 1st to 24th pattern elements composing the 23rd row of the rectangular pattern are turned on 159th, 351st, 543rd, 393rd, 201st, 57th, 81st, 225th, 417th, 567th, 375th, 183rd, 162nd, 354th, 546th, 396th, 204th, 60th, 84th, 228th, 420th, 570th, 378th, and 186th, respectively; and the 1st to 24th pattern elements composing the 24th row of the rectangular pattern are turned on 255th, 447th, 489th, 297th, 105th, 9th, 33rd, 129th, 321st, 513th, 471st, 279th, 258th, 450th, 492nd, 300th, 108th, 12th, 36th, 132nd, 324th, 516th, 474th, and 282nd, respectively.

27. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 576 pattern elements arranged in a matrix of 24 rows×24 columns that are turned on in the following manner: the 1st to 24th pattern elements composing the first row of the rectangular pattern are turned on 495th, 279th, 87th, 39th, 15th, 135th, 327th, 567th, 493rd, 277th, 85th, 37th, 13th, 133rd, 325th, 565th, 497th, 281st, 89th, 41st, 17th, 137th, 329th, and 569th, respectively; the 1st to 24th pattern elements composing the second row of the rectangular pattern are turned on 399th, 255th, 183rd, 111th, 63rd, 159th, 447th, 543rd, 397th, 253rd, 181st, 109th, 61st, 157th, 445th, 541st, 401st, 257th, 185th, 113th, 65th, 161st, 449th, and 545th, respectively; the 1st to 24th pattern elements composing the third row of the rectangular pattern are turned on 513th, 375th, 423rd, 303rd, 231st, 207th, 351st, 465th, 511th, 373rd, 421st, 301st, 229th, 205th, 349th, 463rd, 515th, 377th, 425th, 305th, 233rd, 209th, 353rd, and 467th, respectively; the 1st to 24th pattern elements composing the fourth row of the rectangular pattern are turned on 297th, 417th, 369th, 519th, 471st, 345th, 201st, 225th, 295th, 415th, 367th, 517th, 469th, 343rd, 199th, 223rd, 299th, 419th, 371st, 521st, 473rd, 347th, 203rd, and 227th, respectively; the 1st to 24th pattern elements composing the fifth row of the rectangular pattern are turned on 105th, 177th, 249th, 393rd, 537th, 441st, 153rd, 57th, 103rd, 175th, 247th, 391st, 535th, 439th, 151st, 55th, 107th, 179th, 251st, 395th, 539th, 443rd, 155th, and 59th, respectively; the 1st to 24th pattern elements composing the sixth row of the rectangular pattern are turned on 33rd, 81st, 273rd, 489th, 561st, 321st, 129th, 9th, 31st, 79th, 271st, 487th, 559th, 319th, 127th, 7th, 35th, 83rd, 275th, 491st, 563rd, 323rd, 131st, and 11th, respectively; the 1st to 24th pattern elements composing the seventh row of the rectangular pattern are turned on 21st, 141st, 333rd, 573rd, 501st, 285th, 93rd, 45th, 19th, 139th, 331st, 571st, 499th, 283rd, 91st, 43rd, 23rd, 143rd, 335th, 575th, 503rd, 287th, 95th, and 47th, respectively; the 1st to 24th pattern elements composing the eighth row of the rectangular pattern are turned on 69th, 165th, 453rd, 549th, 405th, 261st, 189th, 117th, 67th, 163rd, 451st, 547th, 403rd, 259th, 187th, 115th, 71st, 167th, 455th, 551st, 407th, 263rd, 191st, and 119th, respectively; the 1st to 24th pattern elements composing the ninth row of the rectangular pattern are turned on 237th, 213th, 357th, 459th, 507th, 381st, 429th, 309th, 235th, 211th, 355th, 457th, 505th, 379th, 427th, 307th, 239th, 215th, 359th, 461st, 509th, 383rd, 431st, and 311th, respectively; the 1st to 24th pattern elements composing the 10th row of the rectangular pattern are turned on 477th, 339th, 195th, 219th, 291st, 411th, 363rd, 525th, 475th, 337th, 193rd, 217th, 289th, 409th, 361st, 523rd,

479th, 341st, 197th, 221st, 293rd, 413th, 365th, and 527th, respectively; the 1st to 24th pattern elements composing the 11th row of the rectangular pattern are turned on 531st, 435th, 147th, 51st, 99th, 171st, 243rd, 387th, 529th, 433rd, 145th, 49th, 97th, 169th, 241st, 385th, 533rd, 437th, 149th, 53rd, 101st, 173rd, 245th, and 389th, respectively; the 1st to 24th pattern elements composing the twelfth row of the rectangular pattern are turned on 555th, 315th, 123rd, 3rd, 27th, 75th, 267th, 483rd, 553rd, 313th, 121st, 1st, 25th, 73rd, 265th, 481st, 557th, 317th, 125th, 5th, 29th, 77th, 269th, and 485th, respectively; the 1st to 24th pattern elements composing the 13th row of the rectangular pattern are turned on 498th, 282nd, 90th, 42nd, 18th, 138th, 330th, 570th, 494th, 278th, 86th, 38th, 14th, 134th, 326th, 566th, 496th, 280th, 88th, 40th, 16th, 136th, 328th, and 568th, respectively; the 1st to 24th pattern elements composing the 14th row of the rectangular pattern are turned on 402nd, 258th, 186th, 114th, 66th, 162nd, 450th, 546th, 398th, 254th, 182nd, 110th, 62nd, 158th, 446th, 542nd, 400th, 256th, 184th, 112th, 64th, 160th, 448th, and 544th, respectively; the 1st to 24th pattern elements composing the 15th row of the rectangular pattern are turned on 516th, 378th, 426th, 306th, 234th, 210th, 354th, 468th, 512th, 374th, 422nd, 302nd, 230th, 206th, 350th, 464th, 514th, 376th, 424th, 304th, 232nd, 208th, 352nd, and 466th, respectively; the 1st to 24th pattern elements composing the 16th row of the rectangular pattern are turned on 300th, 420th, 372nd, 522nd, 474th, 348th, 204th, 228th, 296th, 416th, 368th, 518th, 470th, 344th, 200th, 224th, 298th, 418th, 370th, 520th, 472nd, 346th, 202nd, and 226th, respectively; the 1st to 24th pattern elements composing the 17th row of the rectangular pattern are turned on 108th, 180th, 252nd, 396th, 540th, 444th, 156th, 60th, 104th, 176th, 248th, 392nd, 536th, 440th, 152nd, 56th, 106th, 178th, 250th, 394th, 538th, 442nd, 154th, and 58th, respectively; the 1st to 24th pattern elements composing the 18th row of the rectangular pattern are turned on 36th, 84th, 276th, 492nd, 564th, 324th, 132nd, 12th, 32nd, 80th, 272nd, 488th, 560th, 320th, 128th, 8th, 34th, 82nd, 274th, 490th, 562nd, 322nd, 130th, and 10th, respectively; the 1st to 24th pattern elements composing the 19th row of the rectangular pattern are turned on 24th, 144th, 336th, 576th, 504th, 288th, 96th, 48th, 20th, 140th, 332nd, 572nd, 500th, 284th, 92nd, 44th, 22nd, 142nd, 334th, 574th, 502nd, 286th, 94th, and 46th, respectively; the 1st to 24th pattern elements composing the 20th row of the rectangular pattern are turned on 72nd, 168th, 456th, 552nd, 408th, 264th, 192nd, 120th, 68th, 164th, 452nd, 548th, 404th, 260th, 188th, 116th, 70th, 166th, 454th, 550th, 406th, 262nd, 190th, and 118th, respectively; the 1st to 24th pattern elements composing the 21st row of the rectangular pattern are turned on 240th, 216th, 360th, 462nd, 510th, 384th, 432nd, 312th, 236th, 212th, 356th, 458th, 506th, 380th, 428th, 308th, 238th, 214th, 358th, 460th, 508th, 382nd, 430th, and 310th, respectively; the 1st to 24th pattern elements composing the 22nd row of the rectangular pattern are turned on 480th, 342nd, 198th, 222nd, 294th, 414th, 366th, 528th, 476th, 338th, 194th, 218th, 290th, 410th, 362nd, 524th, 478th, 340th, 196th, 220th, 292nd, 412th, 364th, and 526th, respectively; the 1st to 24th pattern elements composing the 23rd row of the rectangular pattern are turned on 534th, 438th, 150th, 54th, 102nd, 174th, 246th, 390th, 530th, 434th, 146th, 50th, 98th, 170th, 242nd, 386th, 532nd, 436th, 148th, 52nd, 100th, 172nd, 244th, and 388th, respectively; and the 1st to 24th pattern elements composing the 24th row of the rectangular pattern are turned on 558th, 318th, 126th, 6th, 30th, 78th, 270th, 486th, 554th, 314th,

122nd, 2nd, 26th, 74th, 266th, 482nd, 556th, 316th, 124th, 4th, 28th, 76th, 268th, and 484th, respectively.

28. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 576 pattern elements arranged in a matrix of 24 rows×24 columns that are turned on in the following manner: the 1st to 24th pattern elements composing the first row of the rectangular pattern are turned on 495th, 351st, 135th, 39th, 15th, 87th, 327th, 567th, 493rd, 349th, 133rd, 37th, 13th, 85th, 325th, 565th, 497th, 353rd, 137th, 41st, 17th, 89th, 329th, and 569th, respectively; the 1st to 24th pattern elements composing the second row of the rectangular pattern are turned on 471st, 375th, 207th, 111th, 63rd, 159th, 303rd, 519th, 469th, 373rd, 205th, 109th, 61st, 157th, 301st, 517th, 473rd, 377th, 209th, 113th, 65th, 161st, 305th, and 521st, respectively; the 1st to 24th pattern elements composing the third row of the rectangular pattern are turned on 537th, 447th, 423rd, 279th, 231st, 183rd, 255th, 393rd, 535th, 445th, 421st, 277th, 229th, 181st, 253rd, 391st, 539th, 449th, 425th, 281st, 233rd, 185th, 257th, and 395th, respectively; the 1st to 24th pattern elements composing the fourth row of the rectangular pattern are turned on 273rd, 417th, 441st, 543rd, 399th, 249th, 177th, 225th, 271st, 415th, 439th, 541st, 397th, 247th, 175th, 223rd, 275th, 419th, 443rd, 545th, 401st, 251st, 179th, and 227th, respectively; the 1st to 24th pattern elements composing the fifth row of the rectangular pattern are turned on 105th, 201st, 369th, 465th, 513th, 297th, 153rd, 57th, 103rd, 199th, 367th, 463rd, 511th, 295th, 151st, 55th, 107th, 203rd, 371st, 467th, 515th, 299th, 155th, and 59th, respectively; the 1st to 24th pattern elements composing the sixth row of the rectangular pattern are turned on 33rd, 129th, 345th, 489th, 561st, 321st, 81st, 9th, 31st, 127th, 343rd, 487th, 559th, 319th, 79th, 7th, 35th, 131st, 347th, 491st, 563rd, 323rd, 83rd, and 11th, respectively; the 1st to 24th pattern elements composing the seventh row of the rectangular pattern are turned on 21st, 93rd, 333rd, 573rd, 501st, 357th, 141st, 45th, 19th, 91st, 331st, 571st, 499th, 355th, 139th, 43rd, 23rd, 95th, 335th, 575th, 503rd, 359th, 143rd, and 47th, respectively; the 1st to 24th pattern elements composing the eighth row of the rectangular pattern are turned on 69th, 165th, 309th, 525th, 477th, 381st, 213th, 117th, 67th, 163rd, 307th, 523rd, 475th, 379th, 211th, 115th, 71st, 167th, 311th, 527th, 479th, 383rd, 215th, and 119th, respectively; the 1st to 24th pattern elements composing the ninth row of the rectangular pattern are turned on 237th, 189th, 261st, 387th, 531st, 453rd, 429th, 285th, 235th, 187th, 259th, 385th, 529th, 451st, 427th, 283rd, 239th, 191st, 263rd, 389th, 533rd, 455th, 431st, and 287th, respectively; the 1st to 24th pattern elements composing the 10th row of the rectangular pattern are turned on 405th, 243rd, 171st, 219th, 267th, 411th, 435th, 549th, 403rd, 241st, 169th, 217th, 265th, 409th, 433rd, 547th, 407th, 245th, 173rd, 221st, 269th, 413th, 437th, and 551st, respectively; the 1st to 24th pattern elements composing the 11th row of the rectangular pattern are turned on 507th, 291st, 147th, 51st, 99th, 195th, 363rd, 459th, 505th, 289th, 145th, 49th, 97th, 193rd, 361st, 457th, 509th, 293rd, 149th, 53rd, 101st, 197th, 365th, and 461st, respectively; the 1st to 24th pattern elements composing the twelfth row of the rectangular pattern are turned on 555th, 315th, 75th, 3rd, 27th, 123rd, 339th, 483rd, 553rd, 313th, 73rd, 1st, 25th, 121st, 337th, 481st, 557th, 317th, 77th, 5th, 29th, 125th, 341st, and 485th, respectively; the 1st to 24th pattern elements composing the 13th row of the rectangular pattern are turned on 498th, 354th, 138th, 42nd, 18th, 90th, 330th, 570th, 494th, 350th, 134th, 38th, 14th, 86th, 326th, 566th, 496th, 352nd, 136th, 40th, 16th, 88th, 328th, and

568th, respectively; the 1st to 24th pattern elements composing the 14th row of the rectangular pattern are turned on 474th, 378th, 210th, 114th, 66th, 162nd, 306th, 522nd, 470th, 374th, 206th, 110th, 62nd, 158th, 302nd, 518th, 472nd, 376th, 208th, 112th, 64th, 160th, 304th, and 520th, respectively; the 1st to 24th pattern elements composing the 15th row of the rectangular pattern are turned on 540th, 450th, 426th, 282nd, 234th, 186th, 258th, 396th, 536th, 446th, 422nd, 278th, 230th, 182nd, 254th, 392nd, 538th, 448th, 424th, 280th, 232nd, 184th, 256th, and 394th, respectively; the 1st to 24th pattern elements composing the 16th row of the rectangular pattern are turned on 276th, 420th, 444th, 546th, 402nd, 252nd, 180th, 228th, 272nd, 416th, 440th, 542nd, 398th, 248th, 176th, 224th, 274th, 418th, 442nd, 544th, 400th, 250th, 178th, and 226th, respectively; the 1st to 24th pattern elements composing the 17th row of the rectangular pattern are turned on 108th, 204th, 372nd, 468th, 516th, 300th, 156th, 60th, 104th, 200th, 368th, 464th, 512th, 296th, 152nd, 56th, 106th, 202nd, 370th, 466th, 514th, 298th, 154th, and 58th, respectively; the 1st to 24th pattern elements composing the 18th row of the rectangular pattern are turned on 36th, 132nd, 348th, 492nd, 564th, 324th, 84th, 12th, 32nd, 128th, 344th, 488th, 560th, 320th, 80th, 8th, 34th, 130th, 346th, 490th, 562nd, 322nd, 82nd, and 10th, respectively; the 1st to 24th pattern elements composing the 19th row of the rectangular pattern are turned on 24th, 96th, 336th, 576th, 504th, 360th, 144th, 48th, 20th, 92nd, 332nd, 572nd, 500th, 356th, 140th, 44th, 22nd, 94th, 334th, 574th, 502nd, 358th, 142nd, and 46th, respectively; the 1st to 24th pattern elements composing the 20th row of the rectangular pattern are turned on 72nd, 168th, 312th, 528th, 480th, 384th, 216th, 120th, 68th, 164th, 308th, 524th, 476th, 380th, 212th, 116th, 70th, 166th, 310th, 526th, 478th, 382nd, 214th, and 118th, respectively; the 1st to 24th pattern elements composing the 21st row of the rectangular pattern are turned on 240th, 192nd, 264th, 390th, 534th, 456th, 432nd, 288th, 236th, 188th, 260th, 386th, 530th, 452nd, 428th, 284th, 238th, 190th, 262nd, 388th, 532nd, 454th, 430th, and 286th, respectively; the 1st to 24th pattern elements composing the 22nd row of the rectangular pattern are turned on 408th, 246th, 174th, 222nd, 270th, 414th, 438th, 552nd, 404th, 242nd, 170th, 218th, 266th, 410th, 434th, 548th, 406th, 244th, 172nd, 220th, 268th, 412th, 436th, and 550th, respectively; the 1st to 24th pattern elements composing the 23rd row of the rectangular pattern are turned on 510th, 294th, 150th, 54th, 102nd, 198th, 366th, 462nd, 506th, 290th, 146th, 50th, 98th, 194th, 362nd, 458th, 508th, 292nd, 148th, 52nd, 100th, 196th, 364th, and 460th, respectively; and the 1st to 24th pattern elements composing the 24th row of the rectangular pattern are turned on 558th, 318th, 78th, 6th, 30th, 126th, 342nd, 486th, 554th, 314th, 74th, 2nd, 26th, 122nd, 338th, 482nd, 556th, 316th, 76th, 4th, 28th, 124th, 340th, and 484th, respectively.

29. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 576 pattern elements arranged in a matrix of 24 rows×24 columns that are turned on in the following manner: the 1st to 24th pattern elements composing the first row of the rectangular pattern are turned on 305th, 497th, 395th, 251st, 107th, 35th, 47th, 119th, 263rd, 407th, 485th, 293rd, 304th, 496th, 394th, 250th, 106th, 34th, 46th, 118th, 262nd, 406th, 484th, and 292nd, respectively; the 1st to 24th pattern elements composing the second row of the rectangular pattern are turned on 209th, 329th, 545th, 419th, 179th, 131st, 143rd, 191st, 431st, 533rd, 317th, 197th, 208th, 328th, 544th, 418th, 178th, 130th, 142nd, 190th, 430th, 532nd, 316th, and 196th, respectively; the 1st to 24th pattern

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elements composing the third row of the rectangular pattern are turned on 65th, 161st, 353rd, 563rd, 443rd, 275th, 287th, 455th, 575th, 341st, 149th, 53rd, 64th, 160th, 352nd, 562nd, 442nd, 274th, 286th, 454th, 574th, 340th, 148th, and 52nd, respectively; the 1st to 24th pattern elements composing the fourth row of the rectangular pattern are turned on 17th, 89th, 233rd, 377th, 515th, 467th, 479th, 527th, 365th, 221st, 77th, 5th, 16th, 88th, 232nd, 376th, 514th, 466th, 478th, 526th, 364th, 220th, 76th, and 4th, respectively; the 1st to 24th pattern elements composing the fifth row of the rectangular pattern are turned on 41st, 113th, 257th, 401st, 491st, 299th, 311th, 503rd, 389th, 245th, 101st, 29th, 40th, 112th, 256th, 400th, 490th, 298th, 310th, 502nd, 388th, 244th, 100th, and 28th, respectively; the 1st to 24th pattern elements composing the sixth row of the rectangular pattern are turned on 137th, 185th, 425th, 539th, 323rd, 203rd, 215th, 335th, 551st, 413th, 173rd, 125th, 136th, 184th, 424th, 538th, 322nd, 202nd, 214th, 334th, 550th, 412th, 172nd, and 124th, respectively; the 1st to 24th pattern elements composing the seventh row of the rectangular pattern are turned on 281st, 449th, 569th, 347th, 155th, 59th, 71st, 167th, 359th, 557th, 437th, 269th, 280th, 448th, 568th, 346th, 154th, 58th, 70th, 166th, 358th, 556th, 436th, and 268th, respectively; the 1st to 24th pattern elements composing the eighth row of the rectangular pattern are turned on 473rd, 521st, 371st, 227th, 83rd, 11th, 23rd, 95th, 239th, 383rd, 509th, 461st, 472nd, 520th, 370th, 226th, 82nd, 10th, 22nd, 94th, 238th, 382nd, 508th, and 460th, respectively; the 1st to 24th pattern elements composing the ninth row of the rectangular pattern are turned on 301st, 493rd, 391st, 247th, 103rd, 31st, 43rd, 115th, 259th, 403rd, 481st, 289th, 302nd, 494th, 392nd, 248th, 104th, 32nd, 44th, 116th, 260th, 404th, 482nd, and 290th, respectively; the 1st to 24th pattern elements composing the 10th row of the rectangular pattern are turned on 205th, 325th, 541st, 415th, 175th, 127th, 139th, 187th, 427th, 529th, 313th, 193rd, 206th, 326th, 542nd, 416th, 176th, 128th, 140th, 188th, 428th, 530th, 314th, and 194th, respectively; the 1st to 24th pattern elements composing the 11th row of the rectangular pattern are turned on 61st, 157th, 349th, 559th, 439th, 271st, 283rd, 451st, 571st, 337th, 145th, 49th, 62nd, 158th, 350th, 560th, 440th, 272nd, 284th, 452nd, 572nd, 338th, 146th, and 50th, respectively; the 1st to 24th pattern elements composing the twelfth row of the rectangular pattern are turned on 13th, 85th, 229th, 373rd, 511th, 463rd, 475th, 523rd, 361st, 217th, 73rd, 1st, 14th, 86th, 230th, 374th, 512th, 464th, 476th, 524th, 362nd, 218th, 74th, and 2nd, respectively; the 1st to 24th pattern elements composing the 13th row of the rectangular pattern are turned on 37th, 109th, 253rd, 397th, 487th, 295th, 307th, 499th, 385th, 241st, 97th, 25th, 38th, 110th, 254th, 398th, 488th, 296th, 308th, 500th, 386th, 242nd, 98th, and 26th, respectively; the 1st to 24th pattern elements composing the 14th row of the rectangular pattern are turned on 133rd, 181st, 421st, 535th, 319th, 199th, 211th, 331st, 547th, 409th, 169th, 121st, 134th, 182nd, 422nd, 536th, 320th, 200th, 212th, 332nd, 548th, 410th, 170th, and 122nd, respectively; the 1st to 24th pattern elements composing the 15th row of the rectangular pattern are turned on 277th, 445th, 565th, 343rd, 151st, 55th, 67th, 163rd, 355th, 553rd, 433rd, 265th, 278th, 446th, 566th, 344th, 152nd, 56th, 68th, 164th, 356th, 554th, 434th, and 266th, respectively; the 1st to 24th pattern elements composing the 16th row of the rectangular pattern are turned on 469th, 517th, 367th, 223rd, 79th, 7th, 19th, 91st, 235th, 379th, 505th, 457th, 470th, 518th, 368th, 224th, 80th, 8th, 20th, 92nd, 236th, 380th, 506th, and 458th, respectively; the 1st to 24th pattern elements composing the 17th row of the

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rectangular pattern are turned on 303rd, 495th, 393rd, 249th, 105th, 33rd, 45th, 117th, 261st, 405th, 483, 291st, 306th, 498th, 396th, 252nd, 108th, 36th, 48th, 120th, 264th, 408th, 486th, and 294th, respectively; the 1st to 24th pattern elements composing the 18th row of the rectangular pattern are turned on 207th, 327th, 543rd, 417th, 177th, 129th, 141st, 189th, 429th, 531st, 315th, 195th, 210th, 330th, 546th, 420th, 180th, 132nd, 144th, 192nd, 432nd, 534th, 318th, and 198th, respectively; the 1st to 24th pattern elements composing the 19th row of the rectangular pattern are turned on 63rd, 159th, 351st, 561st, 441st, 273rd, 285th, 453rd, 573rd, 339th, 147th, 51st, 66th, 162nd, 354th, 564th, 444th, 276th, 288th, 456th, 576th, 342nd, 150th, and 54th, respectively; the 1st to 24th pattern elements composing the 20th row of the rectangular pattern are turned on 15th, 87th, 231st, 375th, 513th, 465th, 477th, 525th, 363rd, 219th, 75th, 3rd, 18th, 90th, 234th, 378th, 516th, 468th, 480th, 528th, 366th, 222nd, 78th, and 6th, respectively; the 1st to 24th pattern elements composing the 21st row of the rectangular pattern are turned on 39th, 111th, 255th, 399th, 489th, 297th, 309th, 501st, 387th, 243rd, 99th, 27th, 42nd, 114th, 258th, 402nd, 492nd, 300th, 312th, 504th, 390th, 246th, 102nd, and 30th, respectively; the 1st to 24th pattern elements composing the 22nd row of the rectangular pattern are turned on 135th, 183rd, 423rd, 537th, 321st, 201st, 213th, 333rd, 549th, 411th, 171st, 123rd, 138th, 186th, 426th, 540th, 324th, 204th, 216th, 336th, 552nd, 414th, 174th, and 126th, respectively; the 1st to 24th pattern elements composing the 23rd row of the rectangular pattern are turned on 279th, 447th, 567th, 345th, 153rd, 57th, 69th, 165th, 357th, 555th, 435th, 267th, 282nd, 450th, 570th, 348th, 156th, 60th, 72nd, 168th, 360th, 558th, 438th, and 270th, respectively; and the 1st to 24th pattern elements composing the 24th row of the rectangular pattern are turned on 471st, 519th, 369th, 225th, 81st, 9th, 21st, 93rd, 237th, 381st, 507th, 459th, 474th, 522nd, 372nd, 228th, 84th, 12th, 24th, 96th, 240th, 384th, 510th, and 462nd, respectively.

30. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 576 pattern elements arranged in a matrix of 24 rows×24 columns that are turned on in the following manner: the 1st to 24th pattern elements composing the first row of the rectangular pattern are turned on 257th, 449th, 515th, 323rd, 131st, 35th, 47th, 143rd, 335th, 527th, 437th, 245th, 256th, 448th, 514th, 322nd, 130th, 34th, 46th, 142nd, 334th, 526th, 436th, and 244th, respectively; the 1st to 24th pattern elements composing the second row of the rectangular pattern are turned on 161st, 353rd, 545th, 419th, 203rd, 83rd, 95th, 215th, 431st, 533rd, 341st, 149th, 160th, 352nd, 544th, 418th, 202nd, 82nd, 94th, 214th, 430th, 532nd, 340th, and 148th, respectively; the 1st to 24th pattern elements composing the third row of the rectangular pattern are turned on 65th, 185th, 401st, 563rd, 371st, 227th, 239th, 383rd, 575th, 389th, 173rd, 53rd, 64th, 184th, 400th, 562nd, 370th, 226th, 238th, 382nd, 574th, 388th, 172nd, and 52nd, respectively; the 1st to 24th pattern elements composing the fourth row of the rectangular pattern are turned on 17th, 113th, 305th, 497th, 467th, 275th, 287th, 479th, 485th, 293rd, 101st, 5th, 16th, 112th, 304th, 496th, 466th, 274th, 286th, 478th, 484th, 292nd, 100th, and 4th, respectively; the 1st to 24th pattern elements composing the fifth row of the rectangular pattern are turned on 41st, 137th, 329th, 521st, 443rd, 251st, 263rd, 455th, 509th, 317th, 125th, 29th, 40th, 136th, 328th, 520th, 442nd, 250th, 262nd, 454th, 508th, 316th, 124th, and 28th, respectively; the 1st to 24th pattern elements composing the sixth row of the rectangular pattern are turned on 89th, 209th, 425th, 539th, 347th, 155th, 167th,

359th, 551st, 413th, 197th, 77th, 88th, 208th, 424th, 538th, 346th, 154th, 166th, 358th, 550th, 412th, 196th, and 76th, respectively; the 1st to 24th pattern elements composing the seventh row of the rectangular pattern are turned on 233rd, 377th, 569th, 395th, 179th, 59th, 71st, 191st, 407th, 557th, 365th, 221st, 232nd, 376th, 568th, 394th, 178th, 58th, 70th, 190th, 406th, 556th, 364th, and 220th, respectively; the 1st to 24th pattern elements composing the eighth row of the rectangular pattern are turned on 281st, 473rd, 491st, 299th, 107th, 11th, 23rd, 119th, 311th, 503rd, 461st, 269th, 280th, 472nd, 490th, 298th, 106th, 10th, 22nd, 118th, 310th, 502nd, 460th, and 268th, respectively; the 1st to 24th pattern elements composing the ninth row of the rectangular pattern are turned on 253rd, 445th, 511th, 319th, 127th, 31st, 43rd, 139th, 331st, 523rd, 433rd, 241st, 254th, 446th, 512th, 320th, 128th, 32nd, 44th, 140th, 332nd, 524th, 434th, and 242nd, respectively; the 1st to 24th pattern elements composing the 10th row of the rectangular pattern are turned on 157th, 349th, 541st, 415th, 199th, 79th, 91st, 211th, 427th, 529th, 337th, 145th, 158th, 350th, 542nd, 416th, 200th, 80th, 92nd, 212th, 428th, 530th, 338th, and 146th, respectively; the 1st to 24th pattern elements composing the 11th row of the rectangular pattern are turned on 61st, 181st, 397th, 559th, 367th, 223rd, 235th, 379th, 571st, 385th, 169th, 49th, 62nd, 182nd, 398th, 560th, 368th, 224th, 236th, 380th, 572nd, 386th, 170th, and 50th, respectively; the 1st to 24th pattern elements composing the twelfth row of the rectangular pattern are turned on 13th, 109th, 301st, 493rd, 463rd, 271st, 283rd, 475th, 481st, 289th, 97th, 1st, 14th, 110th, 302nd, 494th, 464th, 272nd, 284th, 476th, 482nd, 290th, 98th, and 2nd, respectively; the 1st to 24th pattern elements composing the 13th row of the rectangular pattern are turned on 37th, 133rd, 325th, 517th, 439th, 247th, 259th, 451st, 505th, 313th, 121st, 25th, 38th, 134th, 326th, 518th, 440th, 248th, 260th, 452nd, 506th, 314th, 122nd, and 26th, respectively; the 1st to 24th pattern elements composing the 14th row of the rectangular pattern are turned on 85th, 205th, 421st, 535th, 343rd, 151st, 163rd, 355th, 547th, 409th, 193rd, 73rd, 86th, 206th, 422nd, 536th, 344th, 152nd, 164th, 356th, 548th, 410th, 194th, and 74th, respectively; the 1st to 24th pattern elements composing the 15th row of the rectangular pattern are turned on 229th, 373rd, 565th, 391st, 175th, 55th, 67th, 187th, 403rd, 553rd, 361st, 217th, 230th, 374th, 566th, 392nd, 176th, 56th, 68th, 188th, 404th, 554th, 362nd, and 218th, respectively; the 1st to 24th pattern elements composing the 16th row of the rectangular pattern are turned on 277th, 469th, 487th, 295th, 103rd, 7th, 19th, 115th, 307th, 499th, 457th, 265th, 278th, 470th, 488th, 296th, 104th, 8th, 20th, 116th, 308th, 500th, 458th, and 266th, respectively; the 1st to 24th pattern elements composing the 17th row of the rectangular pattern are turned on 255th, 447th, 513th, 321st, 129th, 33rd, 45th, 141st, 333rd, 525th, 435th, 243rd, 258th, 450th, 516th, 324th, 132nd, 36th, 48th, 144th, 336th, 528th, 438th, and 246th, respectively; the 1st to 24th pattern elements composing the 18th row of the rectangular pattern are turned on 159th, 351st, 543rd, 417th, 201st, 81st, 93rd, 213th, 429th, 531st, 339th, 147th, 162nd, 354th, 546th, 420th, 204th, 84th, 96th, 216th, 432nd, 534th, 342nd, and 150th, respectively; the 1st to 24th pattern elements composing the 19th row of the rectangular pattern are turned on 63rd, 183rd, 399th, 561st, 369th, 225th, 237th, 381st, 573rd, 387th, 171st, 51st, 66th, 186th, 402nd, 564th, 372nd, 228th, 240th, 384th, 576th, 390th, 174th, and 54th, respectively; the 1st to 24th pattern elements composing the 20th row of the rectangular pattern are turned on 15th, 111th, 303rd, 495th, 465th, 273rd, 285th, 477th, 483rd, 291st, 99th, 3rd, 18th, 114th, 306th, 498th,

468th, 276th, 288th, 480th, 486th, 294th, 102nd, and 6th, respectively; the 1st to 24th pattern elements composing the 21st row of the rectangular pattern are turned on 39th, 135th, 327th, 519th, 441st, 249th, 261st, 453rd, 507th, 315th, 123rd, 27th, 42nd, 138th, 330th, 522nd, 444th, 252nd, 264th, 456th, 510th, 318th, 126th, and 30th, respectively; the 1st to 24th pattern elements composing the 22nd row of the rectangular pattern are turned on 87th, 207th, 423rd, 537th, 345th, 153rd, 165th, 357th, 549th, 411th, 195th, 75th, 90th, 210th, 426th, 540th, 348th, 156th, 168th, 360th, 552nd, 414th, 198th, and 78th, respectively; the 1st to 24th pattern elements composing the 23rd row of the rectangular pattern are turned on 231st, 375th, 567th, 393rd, 177th, 57th, 69th, 189th, 405th, 555th, 363rd, 219th, 234th, 378th, 570th, 396th, 180th, 60th, 72nd, 192nd, 408th, 558th, 366th, and 222nd, respectively; and the 1st to 24th pattern elements composing the 24th row of the rectangular pattern are turned on 279th, 471st, 489th, 297th, 105th, 9th, 21st, 117th, 309th, 501st, 459th, 267th, 282nd, 474th, 492nd, 300th, 108th, 12th, 24th, 120th, 312th, 504th, 462nd, and 270th, respectively.

31. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 576 pattern elements arranged in a matrix of 24 rows×24 columns that are turned on in the following manner: the 1st to 24th pattern elements composing the first row of the rectangular pattern are turned on 483rd, 243rd, 75th, 27th, 39th, 123rd, 315th, 543rd, 481st, 241st, 73rd, 25th, 37th, 121st, 313th, 541st, 485th, 245th, 77th, 29th, 41st, 125th, 317th, and 545th, respectively; the 1st to 24th pattern elements composing the second row of the rectangular pattern are turned on 375th, 255th, 171st, 135th, 87th, 183rd, 435th, 555th, 373rd, 253rd, 169th, 133rd, 85th, 181st, 433rd, 553rd, 377th, 257th, 173rd, 137th, 89th, 185th, 437th, and 557th, respectively; the 1st to 24th pattern elements composing the third row of the rectangular pattern are turned on 513th, 387th, 447th, 327th, 267th, 279th, 399th, 465th, 511th, 385th, 445th, 325th, 265th, 277th, 397th, 463rd, 515th, 389th, 449th, 329th, 269th, 281st, 401st, and 467th, respectively; the 1st to 24th pattern elements composing the fourth row of the rectangular pattern are turned on 297th, 417th, 357th, 567th, 495th, 345th, 201st, 213th, 295th, 415th, 355th, 565th, 493rd, 343rd, 199th, 211th, 299th, 419th, 359th, 569th, 497th, 347th, 203rd, and 215th, respectively; the 1st to 24th pattern elements composing the fifth row of the rectangular pattern are turned on 105th, 165th, 225th, 369th, 525th, 429th, 153rd, 57th, 103rd, 163rd, 223rd, 367th, 523rd, 427th, 151st, 55th, 107th, 167th, 227th, 371st, 527th, 431st, 155th, and 59th, respectively; the 1st to 24th pattern elements composing the sixth row of the rectangular pattern are turned on 21st, 69th, 237th, 477th, 537th, 309th, 117th, 9th, 19th, 67th, 235th, 475th, 535th, 307th, 115th, 7th, 23rd, 71st, 239th, 479th, 539th, 311th, 119th, and 11th, respectively; the 1st to 24th pattern elements composing the seventh row of the rectangular pattern are turned on 45th, 129th, 321st, 549th, 489th, 249th, 81st, 33rd, 43rd, 127th, 319th, 547th, 487th, 247th, 79th, 31st, 47th, 131st, 323rd, 551st, 491st, 251st, 83rd, and 35th, respectively; the 1st to 24th pattern elements composing the eighth row of the rectangular pattern are turned on 93rd, 189th, 441st, 561st, 381st, 261st, 177th, 141st, 91st, 187th, 439th, 559th, 379th, 259th, 175th, 139th, 95th, 191st, 443rd, 563rd, 383rd, 263rd, 179th, and 143rd, respectively; the 1st to 24th pattern elements composing the ninth row of the rectangular pattern are turned on 273rd, 285th, 405th, 459th, 507th, 393rd, 453rd, 333rd, 271st, 283rd, 403rd, 457th, 505th, 391st, 451st, 331st, 275th, 287th, 407th, 461st, 509th,

395th, 455th, and 335th, respectively; the 1st to 24th pattern elements composing the 10th row of the rectangular pattern are turned on 501st, 339th, 195th, 207th, 291st, 411th, 351st, 573rd, 499th, 337th, 193rd, 205th, 289th, 409th, 349th, 571st, 503rd, 341st, 197th, 209th, 293rd, 413th, 353rd, and 575th, respectively; the 1st to 24th pattern elements composing the 11th row of the rectangular pattern are turned on 519th, 423rd, 147th, 51st, 99th, 159th, 219th, 363rd, 517th, 421st, 145th, 49th, 97th, 157th, 217th, 361st, 521st, 425th, 149th, 53rd, 101st, 161st, 221st, and 365th, respectively; the 1st to 24th pattern elements composing the twelfth row of the rectangular pattern are turned on 531st, 303rd, 111th, 3rd, 15th, 63rd, 231st, 471st, 529th, 301st, 109th, 1st, 13th, 61st, 229th, 469th, 533rd, 305th, 113th, 5th, 17th, 65th, 233rd, and 473rd, respectively; the 1st to 24th pattern elements composing the 13th row of the rectangular pattern are turned on 486th, 246th, 78th, 30th, 42nd, 126th, 318th, 546th, 482nd, 242nd, 74th, 26th, 38th, 122nd, 314th, 542nd, 484th, 244th, 76th, 28th, 40th, 124th, 316th, and 544th, respectively; the 1st to 24th pattern elements composing the 14th row of the rectangular pattern are turned on 378th, 258th, 174th, 138th, 90th, 186th, 438th, 558th, 374th, 254th, 170th, 134th, 86th, 182nd, 434th, 554th, 376th, 256th, 172nd, 136th, 88th, 184th, 436th, and 556th, respectively; the 1st to 24th pattern elements composing the 15th row of the rectangular pattern are turned on 516th, 390th, 450th, 330th, 270th, 282nd, 402nd, 468th, 512th, 386th, 446th, 326th, 266th, 278th, 398th, 464th, 514th, 388th, 448th, 328th, 268th, 280th, 400th, and 466th, respectively; the 1st to 24th pattern elements composing the 16th row of the rectangular pattern are turned on 300th, 420th, 360th, 570th, 498th, 348th, 204th, 216th, 296th, 416th, 356th, 566th, 494th, 344th, 200th, 212th, 298th, 418th, 358th, 568th, 496th, 346th, 202nd, and 214th, respectively; the 1st to 24th pattern elements composing the 17th row of the rectangular pattern are turned on 108th, 168th, 228th, 372nd, 528th, 432nd, 156th, 60th, 104th, 164th, 224th, 368th, 524th, 428th, 152nd, 56th, 106th, 166th, 226th, 370th, 526th, 430th, 154th, and 58th, respectively; the 1st to 24th pattern elements composing the 18th row of the rectangular pattern are turned on 24th, 72nd, 240th, 480th, 540th, 312th, 120th, 12th, 20th, 68th, 236th, 476th, 536th, 308th, 116th, 8th, 22nd, 70th, 238th, 478th, 538th, 310th, 118th, and 10th, respectively; the 1st to 24th pattern elements composing the 19th row of the rectangular pattern are turned on 48th, 132nd, 324th, 552nd, 492nd, 252nd, 84th, 36th, 44th, 128th, 320th, 548th, 488th, 248th, 80th, 32nd, 46th, 130th, 322nd, 550th, 490th, 250th, 82nd, and 34th, respectively; the 1st to 24th pattern elements composing the 20th row of the rectangular pattern are turned on 96th, 192nd, 444th, 564th, 384th, 264th, 180th, 144th, 92nd, 188th, 440th, 560th, 380th, 260th, 176th, 140th, 94th, 190th, 442nd, 562nd, 382nd, 262nd, 178th, and 142nd, respectively; the 1st to 24th pattern elements composing the 21st row of the rectangular pattern are turned on 276th, 288th, 408th, 462nd, 510th, 396th, 456th, 336th, 272nd, 284th, 404th, 458th, 506th, 392nd, 452nd, 332nd, 274th, 286th, 406th, 460th, 508th, 394th, 454th, and 334th, respectively; the 1st to 24th pattern elements composing the 22nd row of the rectangular pattern are turned on 504th, 342nd, 198th, 210th, 294th, 414th, 354th, 576th, 500th, 338th, 194th, 206th, 290th, 410th, 350th, 572nd, 502nd, 340th, 196th, 208th, 292nd, 412th, 352nd, and 574th, respectively; the 1st to 24th pattern elements composing the 23rd row of the rectangular pattern are turned on 522nd, 426th, 150th, 54th, 102nd, 162nd, 222nd, 366th, 518th, 422nd, 146th, 50th, 98th, 158th, 218th, 362nd, 520th, 424th, 148th, 52nd, 100th, 160th, 220th, and

364th, respectively; and the 1st to 24th pattern elements composing the 24th row of the rectangular pattern are turned on 534th, 306th, 114th, 6th, 18th, 66th, 234th, 474th, 530th, 302nd, 110th, 2nd, 14th, 62nd, 230th, 470th, 532nd, 304th, 112th, 4th, 16th, 64th, 232nd, and 472nd, respectively.

32. The computer-readable medium according to claim 17, wherein said rectangular pattern is composed of 576 pattern elements arranged in a matrix of 24 rows×24 columns that are turned on in the following manner: the 1st to 24th pattern elements composing the first row of the rectangular pattern are turned on 495th, 315th, 123rd, 39th, 15th, 87th, 327th, 567th, 493rd, 313th, 121st, 37th, 13th, 85th, 325th, 565th, 497th, 317th, 125th, 41st, 17th, 89th, 329th, and 569th, respectively; the 1st to 24th pattern elements composing the second row of the rectangular pattern are turned on 459th, 375th, 207th, 135th, 63rd, 159th, 339th, 519th, 457th, 373rd, 205th, 133rd, 61st, 157th, 337th, 517th, 461st, 377th, 209th, 137th, 65th, 161st, 341st, and 521st, respectively; the 1st to 24th pattern elements composing the third row of the rectangular pattern are turned on 537th, 471st, 411th, 351st, 231st, 183rd, 255th, 393rd, 535th, 469th, 409th, 349th, 229th, 181st, 253rd, 391st, 539th, 473rd, 413th, 353rd, 233rd, 185th, 257th, and 395th, respectively; the 1st to 24th pattern elements composing the fourth row of the rectangular pattern are turned on 273rd, 405th, 441st, 543rd, 423rd, 249th, 177th, 225th, 271st, 403rd, 439th, 541st, 421st, 247th, 175th, 223rd, 275th, 407th, 443rd, 545th, 425th, 251st, 179th, and 227th, respectively; the 1st to 24th pattern elements composing the fifth row of the rectangular pattern are turned on 105th, 201st, 369th, 453rd, 513th, 285th, 153rd, 57th, 103rd, 199th, 367th, 451st, 511th, 283rd, 151st, 55th, 107th, 203rd, 371st, 455th, 515th, 287th, 155th, and 59th, respectively; the 1st to 24th pattern elements composing the sixth row of the rectangular pattern are turned on 33rd, 117th, 309th, 489th, 561st, 297th, 81st, 9th, 31st, 115th, 307th, 487th, 559th, 295th, 79th, 7th, 35th, 119th, 311th, 491st, 563rd, 299th, 83rd, and 11th, respectively; the 1st to 24th pattern elements composing the seventh row of the rectangular pattern are turned on 21st, 93rd, 333rd, 573rd, 501st, 321st, 129th, 45th, 19th, 91st, 331st, 571st, 499th, 319th, 127th, 43rd, 23rd, 95th, 335th, 575th, 503rd, 323rd, 131st, and 47th, respectively; the 1st to 24th pattern elements composing the eighth row of the rectangular pattern are turned on 69th, 165th, 345th, 525th, 465th, 381st, 213th, 141st, 67th, 163rd, 343rd, 523rd, 463rd, 379th, 211th, 139th, 71st, 167th, 347th, 527th, 467th, 383rd, 215th, and 143rd, respectively; the 1st to 24th pattern elements composing the ninth row of the rectangular pattern are turned on 237th, 189th, 261st, 387th, 531st, 477th, 417th, 357th, 235th, 187th, 259th, 385th, 529th, 475th, 415th, 355th, 239th, 191st, 263rd, 389th, 533rd, 479th, 419th, and 359th, respectively; the 1st to 24th pattern elements composing the 10th row of the rectangular pattern are turned on 429th, 243rd, 171st, 219th, 267th, 399th, 435th, 549th, 427th, 241st, 169th, 217th, 265th, 397th, 433rd, 547th, 431st, 245th, 173rd, 221st, 269th, 401st, 437th, and 551st, respectively; the 1st to 24th pattern elements composing the 11th row of the rectangular pattern are turned on 507th, 279th, 147th, 51st, 99th, 195th, 363rd, 447th, 505th, 277th, 145th, 49th, 97th, 193rd, 361st, 445th, 509th, 281st, 149th, 53rd, 101st, 197th, 365th, and 449th, respectively; the 1st to 24th pattern elements composing the twelfth row of the rectangular pattern are turned on 555th, 291st, 75th, 3rd, 27th, 111th, 303rd, 483rd, 553rd, 289th, 73rd, 1st, 25th, 109th, 301st, 481st, 557th, 293rd, 77th, 5th, 29th, 113th, 305th, and 485th, respectively; the 1st to 24th pattern elements composing the 13th row of the rectangular

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pattern are turned on 498th, 318th, 126th, 42nd, 18th, 90th, 330th, 570th, 494th, 314th, 122nd, 38th, 14th, 86th, 326th, 566th, 496th, 316th, 124th, 40th, 16th, 88th, 328th, and 568th, respectively; the 1st to 24th pattern elements composing the 14th row of the rectangular pattern are turned on 462nd, 378th, 210th, 138th, 66th, 162nd, 342nd, 522nd, 458th, 374th, 206th, 134th, 62nd, 158th, 338th, 518th, 460th, 376th, 208th, 136th, 64th, 160th, 340th, and 520th, respectively; the 1st to 24th pattern elements composing the 15th row of the rectangular pattern are turned on 540th, 474th, 414th, 354th, 234th, 186th, 258th, 396th, 536th, 470th, 410th, 350th, 230th, 182nd, 254th, 392nd, 538th, 472nd, 412th, 352nd, 232nd, 184th, 256th, and 394th, respectively; the 1st to 24th pattern elements composing the 16th row of the rectangular pattern are turned on 276th, 408th, 444th, 546th, 426th, 252nd, 180th, 228th, 272nd, 404th, 440th, 542nd, 422nd, 248th, 176th, 224th, 274th, 406th, 442nd, 544th, 424th, 250th, 178th, and 226th, respectively; the 1st to 24th pattern elements composing the 17th row of the rectangular pattern are turned on 108th, 204th, 372nd, 456th, 516th, 288th, 156th, 60th, 104th, 200th, 368th, 452nd, 512th, 284th, 152nd, 56th, 106th, 202nd, 370th, 454th, 514th, 286th, 154th, and 58th, respectively; the 1st to 24th pattern elements composing the 18th row of the rectangular pattern are turned on 36th, 120th, 312th, 492nd, 564th, 300th, 84th, 12th, 32nd, 116th, 308th, 488th, 560th, 296th, 80th, 8th, 34th, 118th, 310th, 490th, 562nd, 298th, 82nd, and 10th, respectively; the 1st to 24th pattern elements composing the 19th row of the rectangular pattern are turned on 24th, 96th, 336th, 576th, 504th, 324th, 132nd, 48th, 20th, 92nd, 332nd, 572nd, 500th, 320th, 128th, 44th, 22nd, 94th, 334th, 574th, 502nd, 322nd, 130th, and 46th, respectively; the 1st to 24th pattern elements composing the 20th row of the rectangular pattern are turned on 72nd, 168th, 348th, 528th, 468th, 384th, 216th, 144th, 68th, 164th,

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344th, 524th, 464th, 380th, 212th, 140th, 70th, 166th, 346th, 526th, 466th, 382nd, 214th, and 142nd, respectively; the 1st to 24th pattern elements composing the 21st row of the rectangular pattern are turned on 240th, 192nd, 264th, 390th, 534th, 480th, 420th, 360th, 236th, 188th, 260th, 386th, 530th, 476th, 416th, 356th, 238th, 190th, 262nd, 388th, 532nd, 478th, 418th, and 358th, respectively; the 1st to 24th pattern elements composing the 22nd row of the rectangular pattern are turned on 432nd, 246th, 174th, 222nd, 270th, 402nd, 438th, 552nd, 428th, 242nd, 170th, 218th, 266th, 398th, 434th, 548th, 430th, 244th, 172nd, 220th, 268th, 400th, 436th, and 550th, respectively; the 1st to 24th pattern elements composing the 23rd row of the rectangular pattern are turned on 510th, 282nd, 150th, 54th, 102nd, 198th, 366th, 450th, 506th, 278th, 146th, 50th, 98th, 194th, 362nd, 446th, 508th, 280th, 148th, 52nd, 100th, 196th, 364th, and 448th, respectively; and the 1st to 24th pattern elements composing the 24th row of the rectangular pattern are turned on 558th, 294th, 78th, 6th, 30th, 114th, 306th, 486th, 554th, 290th, 74th, 2nd, 26th, 110th, 302nd, 482nd, 556th, 292nd, 76th, 4th, 28th, 112th, 304th, and 484th, respectively.

33. The computer-readable medium according to claim **17**, wherein the order of turning-on set for an arbitrary pattern element in said rectangular pattern and that set for the pattern element disposed in a position diametrically symmetrical to said arbitrary pattern element with respect to the center of said rectangular pattern are substituted for each other.

34. The computer-readable medium according to claim **17**, wherein said rectangular pattern for which the sequence of turning-on is set is angularly moved about the pattern center by 90°, clockwise or counterclockwise.

* * * * *